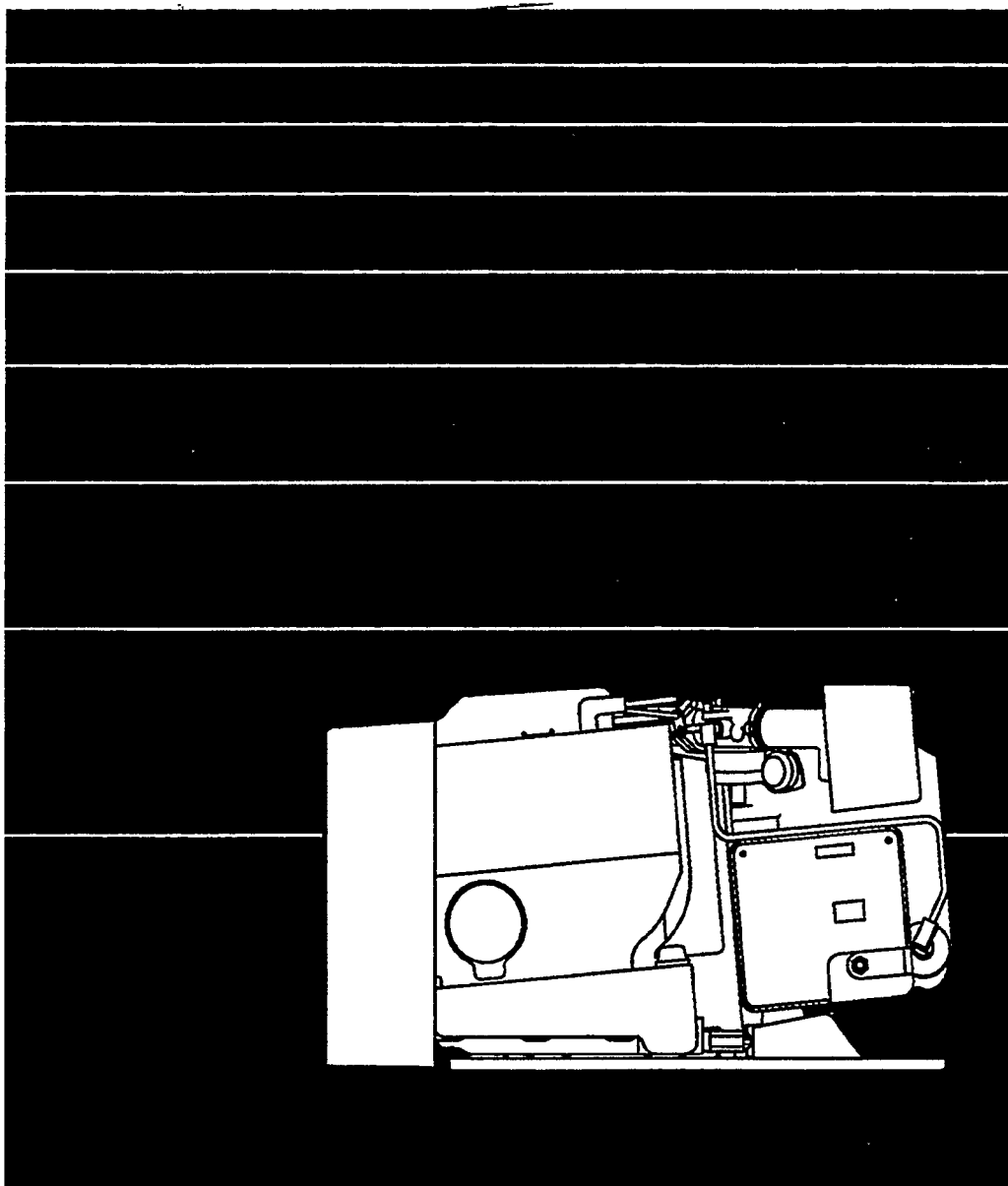




Installation Manual

Model BGD and NHD Generator Sets



Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. Safe and efficient operation can be achieved only if the unit is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER This symbol warns of immediate hazards which will result in severe personal injury or death.

⚠ WARNING This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

⚠ CAUTION This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

FUEL AND FUMES ARE FLAMMABLE. Fire, explosion, and personal injury can result from improper practices.

- DO NOT fill fuel tanks while engine is running. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible, non-conductive line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

GASOLINE AND LPG FUEL MAY BE ACCIDENTALLY IGNITED BY ELECTRICAL SPARKS, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

- Do not tie electrical wiring to fuel lines.
- Do not run electrical lines and fuel lines through the same compartment openings.
- Keep electrical and fuel lines as far apart as possible.
- Place a physical barrier between fuel lines and electrical lines wherever possible.
- If electrical and fuel lines must pass through the same compartment opening, make certain that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

- Never sleep in the vehicle with the generator set running unless vehicle is equipped with an operating carbon monoxide detector.
- Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator set, disconnect batteries. This will prevent accidental arcing.

- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry while working on generator sets. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Have a fire extinguisher nearby. Maintain extinguisher properly and become familiar with its use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.
- Hot coolants under pressure can cause severe personal injury. DO NOT open a radiator pressure cap while the engine is running. Stop the engine and carefully bleed the system pressure.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which presents a potential fire hazard.
- DO NOT store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

Fire, explosion, and personal injury can result from improper practices.

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC-rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work-harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.

- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [-] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (-) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [-] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. Do not tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [-] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

Supplement 965-1048

Date: 6-93

Insert with-

Title: BGD/NHD Installation Manual

Number: 965-0629 Dated 12-91

This supplement adds an updated wiring diagram/schematic to the BGD/NHD (Commercial Emerald) Installation Manual for the Spec H (gasoline-powered, 3-phase) BGD/NHD generator set.

SUMMARY OF CHANGES TO GENERATOR SET

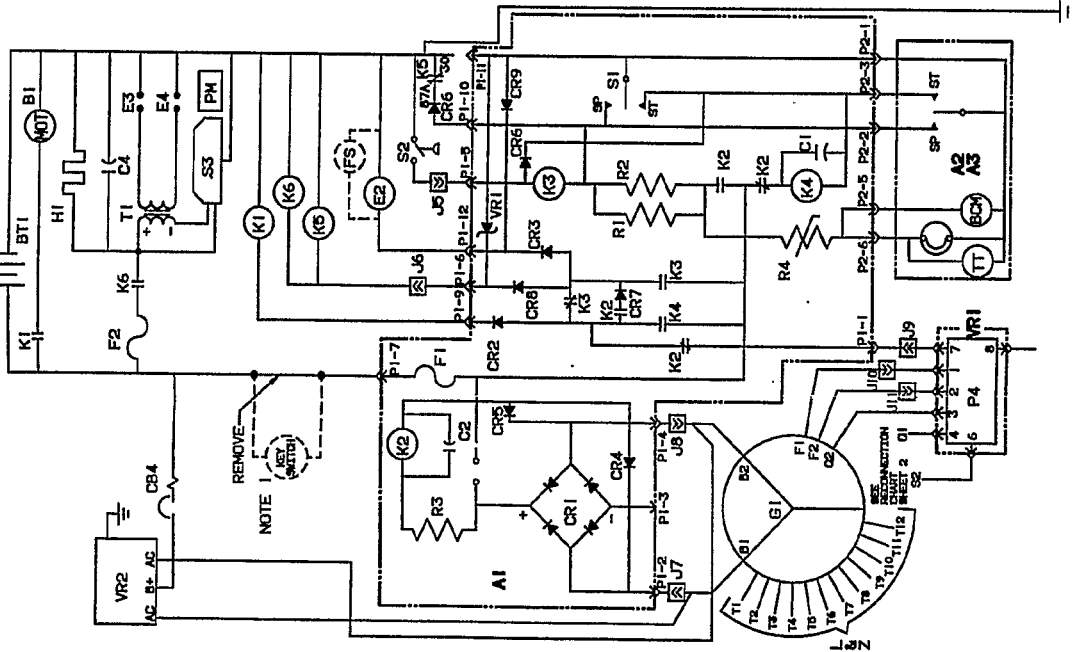
- An externally-mounted Onan SR voltage regulator is added to the 3-phase genset, for AC power regulation.
- A new starter motor is substituted into the set, having no serviceable parts (replace only).
- A steel ring gear (starter) is mounted on the set, replacing the original aluminum part.

These changes should normally be transparent to the operator of the set. **With the exception of the schematic/wiring diagram, there is no difference in the directions for installing the Spec H BGD/NHD generator set.**

CHANGE TO MANUAL

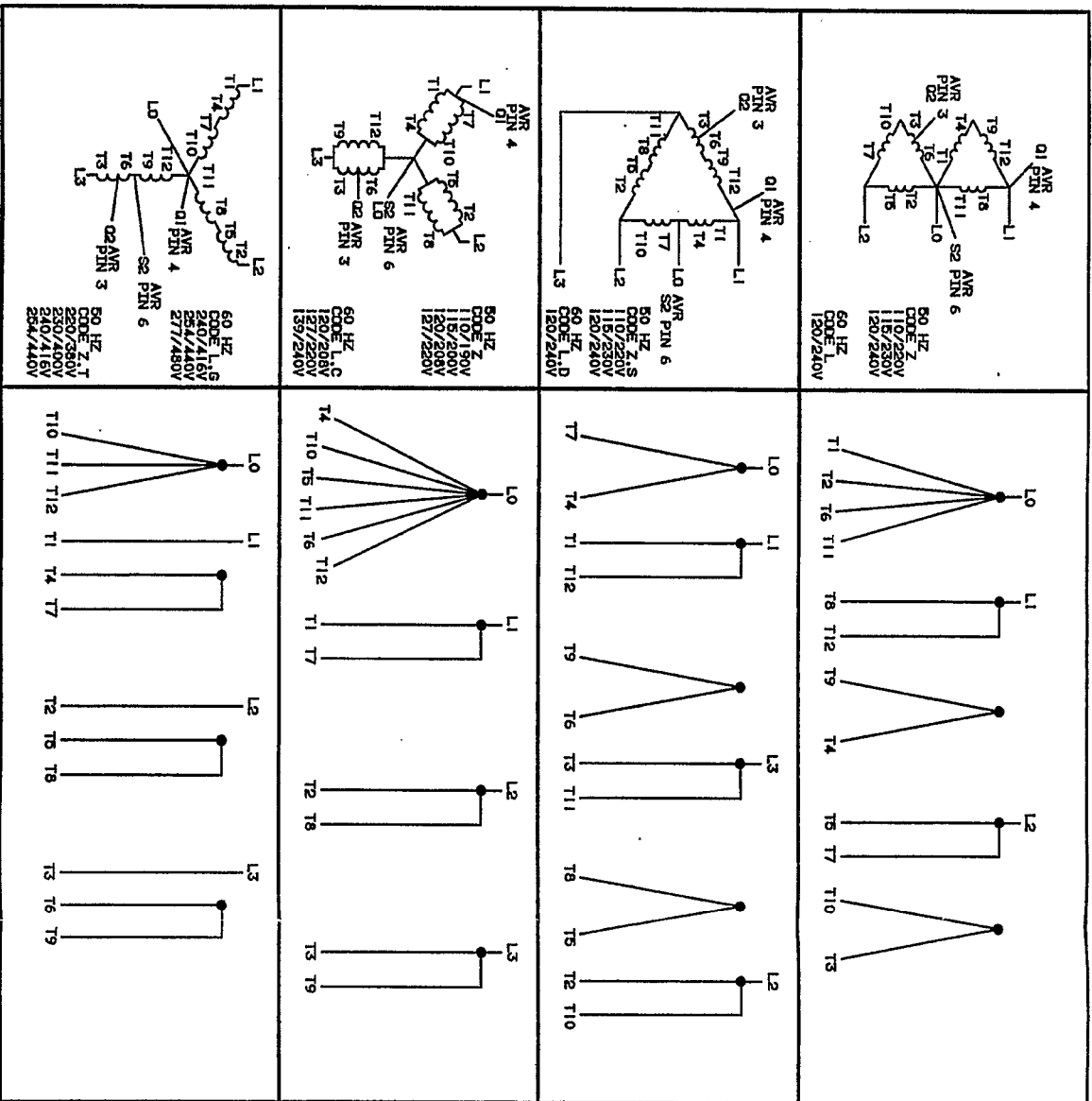
Page 9-7: Substitute the two attached 11 x 17 diagrams, numbered 611-1224 REV. B, for the single drawing found on Page 9-7, numbered 611-1216 REV. B.

SCHEMATIC

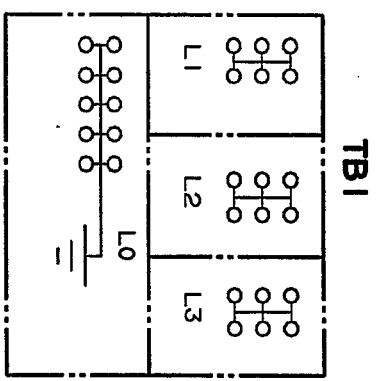


1. DISARM SWITCH BY CUSTOMER/INSTALLER NOT SUPPLIED BY QVAN. REQUIRES CONNECTING WITH NECESSARY EXTENSION LEADS FROM J1-7 TO KEY SWITCH AND CONNECTING FROM KEY SWITCH TO K1-I AND DISCONNECTING LEAD AT K1-I. USE 16 GA CU WIRE.

NO. 611-1224
REV. B
MODIFIED



AC CONNECTION DIAGRAMS FOR THREE-PHASE, GASOLINE-FUELED SETS
9-7b



NO. 611-1224
REV. B
MODIFIED

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Section 1. Introduction

GENERAL

This manual is a guide for the installation of the Model BGD and NHD generator sets in work vehicles. Proper installation is essential for top performance. Read through this manual before starting the installation.

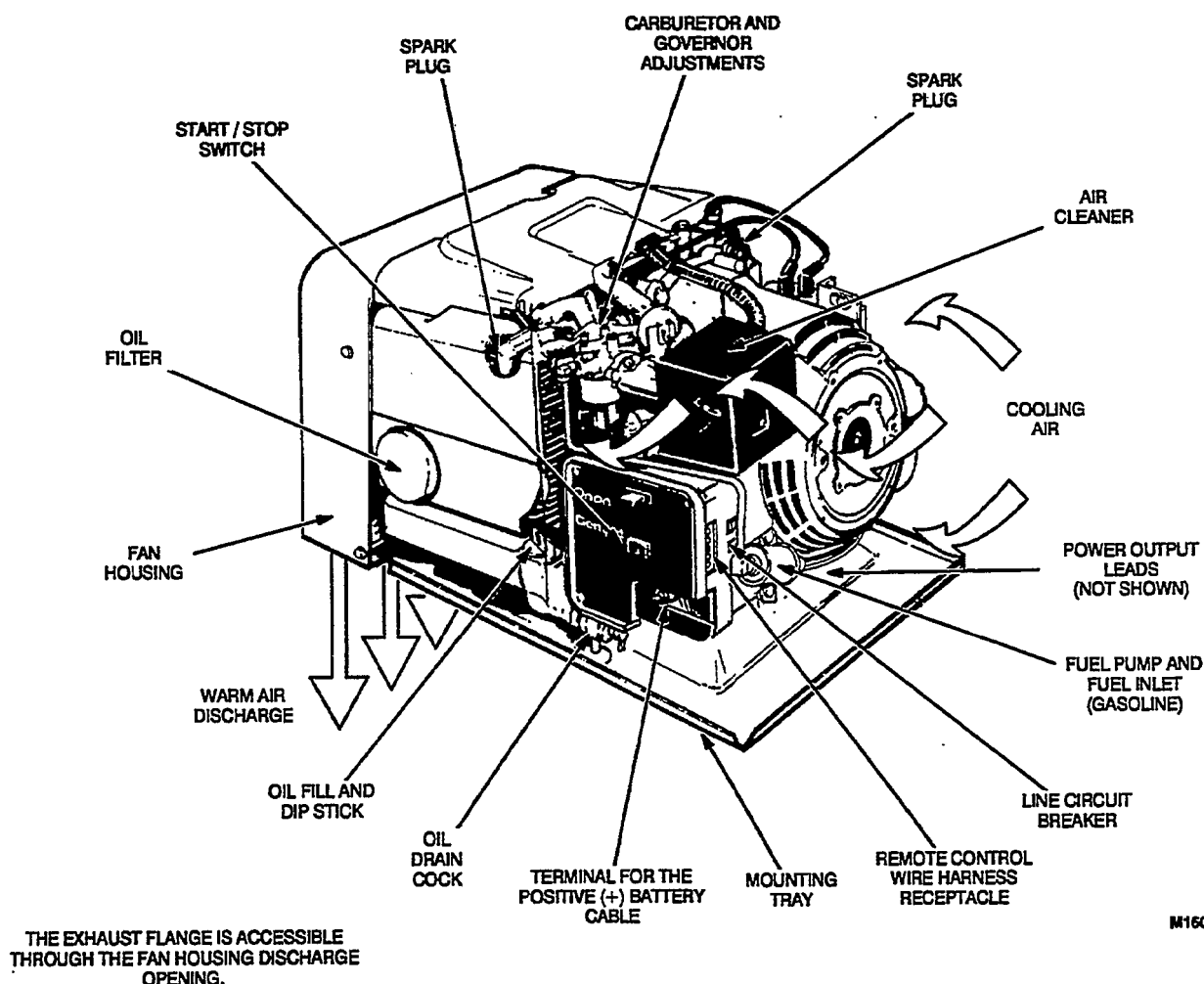
This manual addresses the following aspects of the installation:

- Mounting
- Weather Protection
- Compartment Ventilation
- Acoustics (Noise Reduction)

- Exhaust Connections
- Fuel Connections
- Electrical Power Connections
- Battery Connections
- Accessibility for Maintenance and Service.

⚠ WARNING *Improper installation can result in severe personal injury, death and equipment damage. The installer must be qualified to perform the installation of electrical and mechanical equipment.*

For operation and maintenance, see Operator's Manual 965-0129, and for service, Service Manual 965-0529.



M1604-10a

FIGURE 1-1. TYPICAL GENERATOR SET

INSTALLATION CODES AND STANDARDS FOR SAFETY

The builder of the work vehicle bears sole responsibility for the selection of the appropriate generator set, for its proper installation and for obtaining approvals from the authorities (if any) having jurisdiction over the work vehicle. These sets meet the basic requirements of the Standard for Safety for Engine Generator Sets for Recreational Vehicles, ANSI/RVIA EGS-1—1986*. They are suitable for installation in accordance with:

- Section 3-6 of the Standard for the Storage and Handling of Liquefied Petroleum Gases, NFPA No. 58 (Applies only to sets equipped for using propane.)
- The National Electrical Code, NFPA No. 70
- The Standard on Recreational Vehicles, NFPA No. 501C
- CSA Electrical Bulletin No. 946.

Federal, State and local codes, such as the California Administrative Code—Title 25 (RV installation), might also be applicable. Installation codes and recommendations can change from time-to-time and are different in different countries, states and

municipalities. It is recommended, as a minimum, that the following standards be obtained for reference.

- | | |
|---|---|
| • NFPA No. 58
NFPA No. 70
NFPA No. 501C | National Fire Protection
Association
470 Atlantic Avenue
Boston, MA 02210 |
| • CSA Electrical
Bulletin No.946 | Canadian Standards Association
Housing and Construction
Materials Section
178 Rexdale Blvd.
Rexdale, Ontario,
Canada M9W 1R3 |
| • California
Administrative
Code—Title 25,
Chapter 3 | State of California
Documents Section
P.O. Box 1015
North Highlands, CA 95660 |
| • ANSI/RVIA-EGS-1 | Recreational Vehicle
Industry Association
14650 Lee Road
Chantilly, VA 22021 |

Note: Manuals are updated from time-to-time to reflect changes in the equipment and its specifications. For this reason, only the copy of the installation manual supplied with the set should be used as a guide for the installation

* — Options such as the extended shaft, 50 Hertz output and output voltages greater than 300 volts are not within the scope of this standard.

Section 2. Specifications

	MODEL BGD	MODEL NHD
General		
Weight	204 pounds (92 kg)	230 pounds (104 kg)
Overall Dimensions (H x L x W)	14x25-1/4x19 In. (356x641x478 mm)	14-5/8x25-9/16x21-1/16 In. (371x649x535 mm)
Minimum Free Area for Ventilating Air	85 sq. In. (548 sq. cm)	85 sq. In. (548 sq. cm)
Minimum Vertical Clearance At Air Discharge Outlet	2 In. (51 mm)	2 In. (51 mm)
Required Exhaust Pipe Material	18 gauge, 1-3/8 In. ID Rigid Steel Tubing	18 gauge, 1-3/8 In. ID Rigid Steel Tubing
Engine Oil Capacity (Dry Filter)	3.5 quarts (3.3 L)	3.5 quarts (3.3 L)
Control Panel Fuse (F1)	5 amps Slow-Blow	5 amps Slow-Blow
Ignition/Choke Fuse (F2)	10 amps	10 amps
Spark Plug Gap	0.025 In. (0.64 mm)	0.025 In. (0.64 mm)
Fuel Connections		
Maximum Gasoline Supply Pressure (at Carburetor)	6 psi (41 kPa)	6 psi (41 kPa)
Maximum Gasoline Fuel Pump Lift	3 Ft. (0.9 m)	3 Ft. (0.9 m)
Gasoline Supply Fitting	1/4 In. ID Hose Barb	1/4 In. ID Hose Barb
Min. – Max. Propane Supply Pressure (Vapor Withdrawal)	7 – 14 In. (178 – 356 mm) WC	7 – 14 In. (178 – 356 mm) WC
Propane Supply Connection (Vapor Withdrawal)	3/4 In. NPTF Tapping	3/4 In. NPTF Tapping
Propane Supply Connection (Liquid Withdrawal)	1/4 In. NPTF Tapping	1/4 In. NPTF Tapping
Battery		
Voltage	12	12
Cold Cranking Amps (SAE J537) for Ambients Above / Below Freezing	360 / 450	360 / 450
Minimum Required Voltage At Starter Motor Terminals During Cranking	8	8
Battery Charging Voltage (at No-Load AC)	14.4	14.4
Battery Charging Voltage (at Full-Load AC)	14.6	14.6
Maximum Continuous Battery Charging Amperage	10	10
Trickle Battery Charging Amperage	0.5	0.5

Specifications (Cont.)

	MODEL BGD		MODEL NHD	
	50 Hertz (1500 RPM)	60 Hertz (1800 RPM)	50 Hertz (1500 RPM)	60 Hertz (1800 RPM)
Gasoline Fueled Sets				
Rated Power Output	4.0 kW	4.5 kW	5.0 kW	6.5 kW
Full-Load Current (1-Phase Generators)				
At 110/220 Volts	36.4/18.2 amps	—	45.5/22.7 amps	—
At 120/240 Volts	—	37.5/18.8 amps	—	54.2/27.1 amps
Full-Load Current (3-Phase Generators)				
At 110/220 Volts*	21.0/10.5 amps	—	26.3/13.2 amps	—
At 120/240 Volts*	—	21.7/10.8 amps	—	31.3/15.7 amps
Gasoline Consumption				
Under Full-Load	0.73 gph (2.8 L/h)	0.8 gph (3.0 L/h)	0.8 gph (3.0 L/h)	1.3 gph (4.9 L/h)
Under Half-Load	0.53 gph (2.0 L/h)	0.6 gph (2.3 L/h)	0.57 gph (2.2 L/h)	0.7 gph (2.5 L/h)
Under No-Load	0.35 gph (1.3 L/h)	0.4 gph (1.5 L/h)	0.35 gph (1.3 L/h)	0.4 gph (1.5 L/h)
Propane Fueled Sets				
Rated Power Output	3.5 kW	4.0 kW	5.0 kW	6.3 kW
Full-Load Current (1-Phase Generators)				
At 110/220 Volts	31.8/15.9 amps	—	45.5/22.7 amps	—
At 120/240 Volts	—	33.3/16.7 amps	—	52.5/26.3 amps
Propane Consumption				
Under Full-Load	0.98 gph (3.7 L/h)	1.3 gph (4.9 L/h)	1.18 gph (4.5 L/h)	1.7 gph (6.4 L/h)
Under Half-Load	0.65 gph (2.5 L/h)	0.8 gph (3.0 L/h)	0.78 gph (3.0 L/h)	1.05 gph (4.0 L/h)
Under No-Load	0.4 gph (1.5 L/h)	0.5 gph (1.9 L/h)	0.5 gph (1.9 L/h)	0.65 gph (2.5 L/h)

* – These values are for generators having a Series-Delta connection.

Section 3. Location, Mounting, Enclosure, Venting and Acoustics

LOCATION AND MOUNTING

These generator sets can be mounted at various locations on a work vehicle. They have built-in vibration isolators and a mounting tray for bolting directly to the vehicle floor or supporting frame. Figures 3-1 and 3-2 show typical mountings at various locations. See *Section 9. Outline Drawings and Wiring Diagrams* for dimensions, connection points, minimum clearances and mounting hole locations.

The frame or floor to which the set is bolted must be strong enough to support the dynamic load of the set when the vehicle is moving and to keep the set from being dislodged during a sudden stop or crash. Use four 3/8-16 UNC bolts for mounting. (The rear mounting holes have weld nuts. The front holes can be used with square cage nuts.) Use three inch diameter washers under the bolt heads when bolting the set to plywood or particle board.

⚠ WARNING *The set must be mounted securely to prevent it from being dislodged during a sudden stop or crash. A dislodged set can strike a person, causing severe injury or death.*

⚠ WARNING *Weight distribution affects vehicle braking performance. Check with the vehicle chassis builder to make sure the location of the set will not adversely affect braking.*

ENCLOSURE

The generator set must be protected against the weather and road-splash.

⚠ CAUTION *The generator set can be disabled by electrical shorts and carburetor linkage malfunctioning if rain, snow, ice, road-splash or water from washer nozzles enters the generator set. Also, plastic parts might deteriorate if continually exposed to sunlight. The enclosure or compartment must keep the generator set dry under all conditions and shaded from the sun.*

Sets Mounted On or Above the Vehicle Floor—Outside the Cab or Work-Space Envelope

A cover must be provided that extends across the full width and length of the set if it is mounted outside the envelope of the cab or work-space of the vehicle (Figure 3-1). To keep out rain when the vehicle is moving, the cover should extend down across the full width of the side or end of the set facing the front of the vehicle. Sets mounted on a tailgate extension might need more protection on the sides to keep out road-splash. The minimum allowable clearance between the set and the enclosure

or compartment is 5/8 inches (15 mm). See the appropriate outline drawing (Section 9).

The generator end of a full enclosure should have a minimum of 85 square inches (548 square centimetres) of free area for ventilation. See Ventilation in this Section. If the generator end faces the front of the vehicle, a baffle over the ventilating opening might be necessary to keep out rain when the vehicle is moving.

The enclosure should also protect the auxiliary drive (hydraulic pump) on the end of the generator and the gas pressure demand regulator when the set is so equipped. See Section 5. Fuel Systems and Section 7. Miscellaneous.

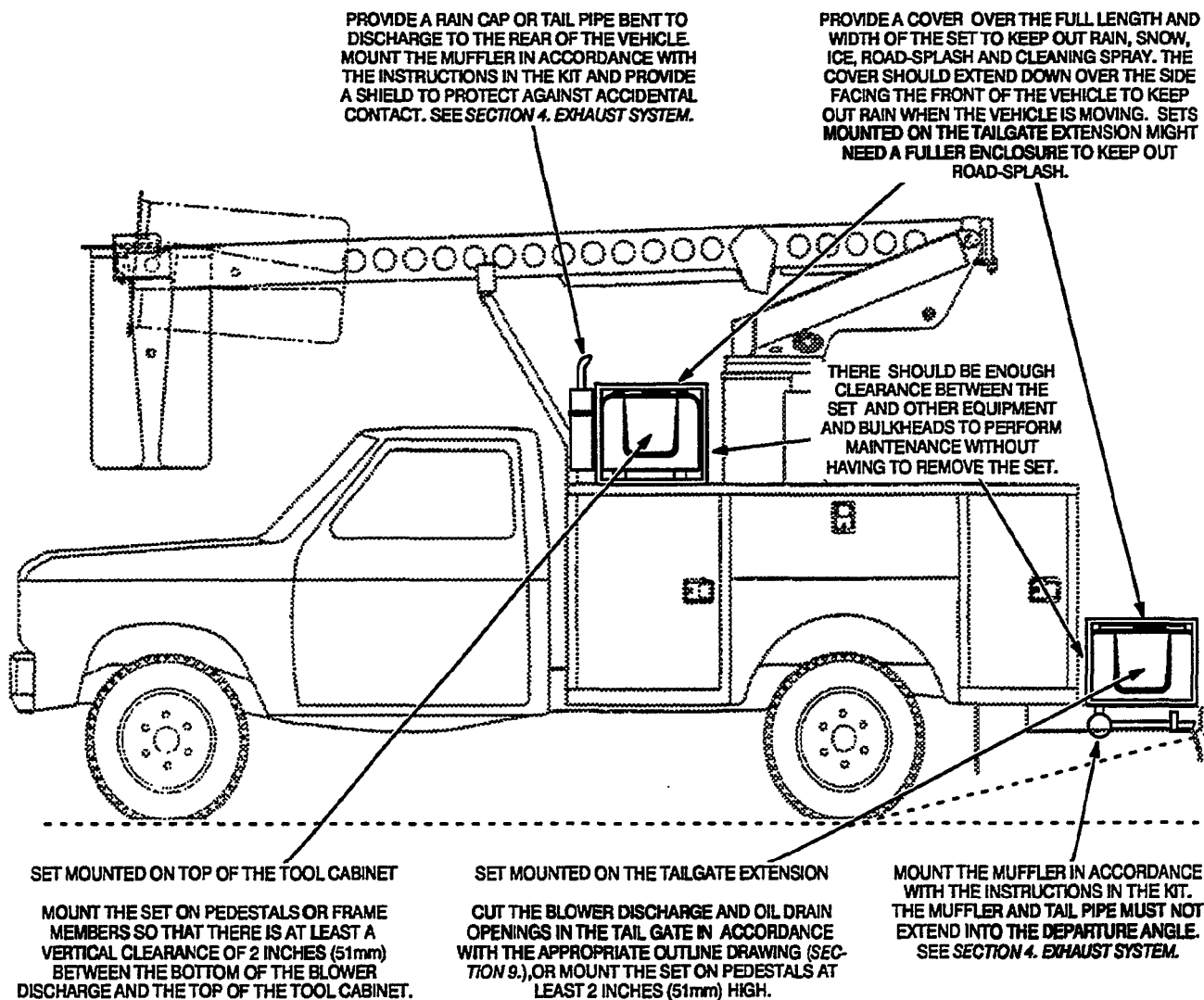


FIGURE 3-1. TYPICAL EXTERIOR MOUNTINGS—OUTSIDE THE CAB OR WORK-SPACE ENVELOPE

Sets Mounted Inside the Cab or Work-Space Envelope

A compartment having vapor-tight, fire-resistant walls must be provided if the set is mounted within the envelope of the cab or work-space of the vehicle (Figure 3-2). The ventilation openings must be to the outside of the vehicle. See Ventilation in this Section.

⚠WARNING Exhaust gas is deadly, and fuel vapors are highly flammable and explosive. The generator compartment walls must be vapor-tight to keep exhaust gas and fuel vapors from entering the vehicle.

The minimum allowable clearance between the set and the enclosure or compartment is 5/8 inches (15 mm). See the appropriate outline drawing (Section 9.). Additional room will be required for a set with an auxiliary drive (hydraulic pump) on the end of the generator or a pressure demand regulator (propane gas fueled sets). See Section 5. Fuel Systems and Section 7. Miscellaneous.

The bottom of the enclosure or compartment must have drain holes or be constructed so that oil and water cannot collect. Absorbent acoustic material must not be placed between the set and the compartment floor.

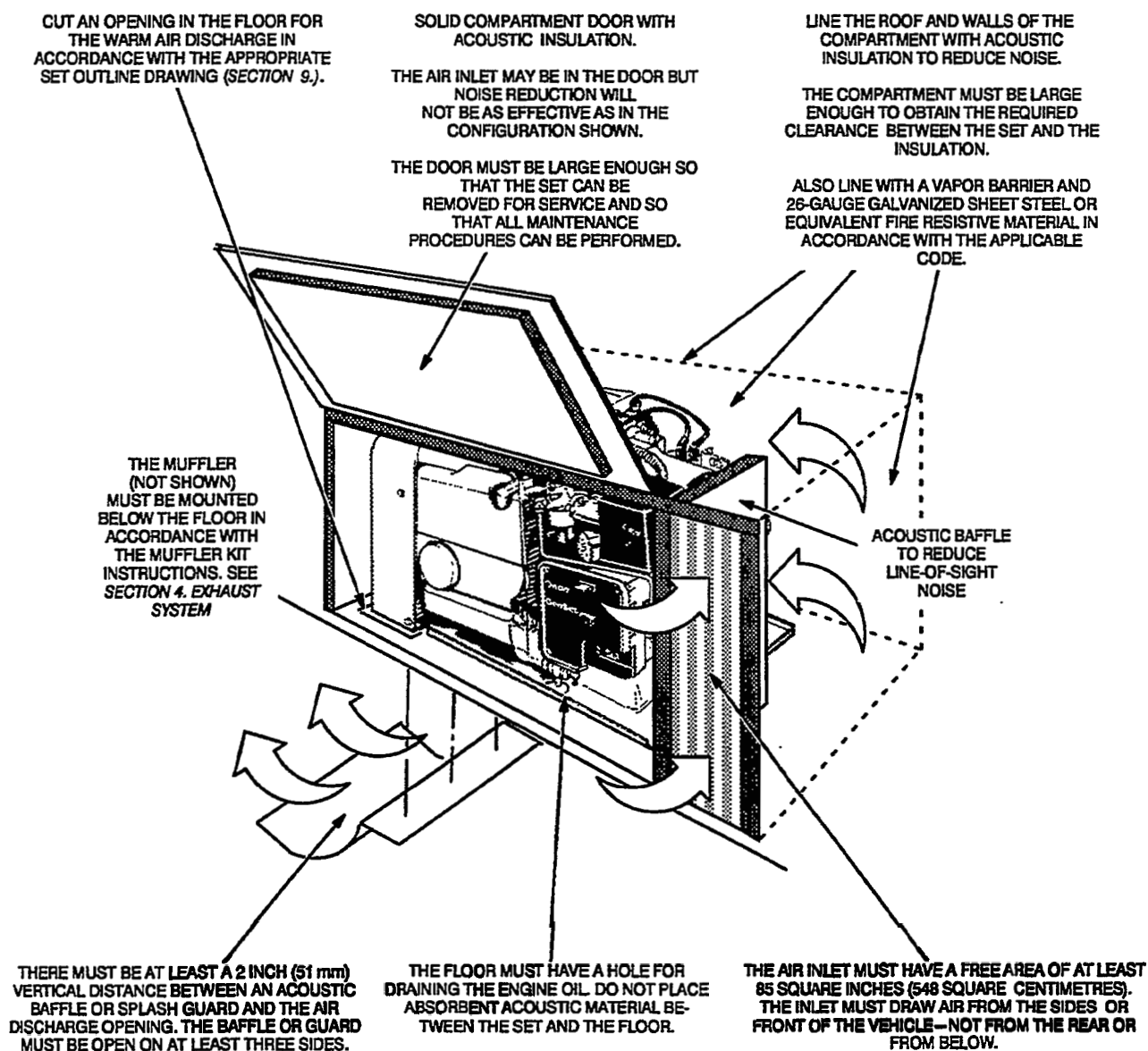


FIGURE 3-2. TYPICAL FLOOR MOUNTING IN A COMPARTMENT WITH ACOUSTIC INSULATION AND FIRE AND VAPOR BARRIERS—INSIDE THE CAB OR WORK-SPACE ENVELOPE

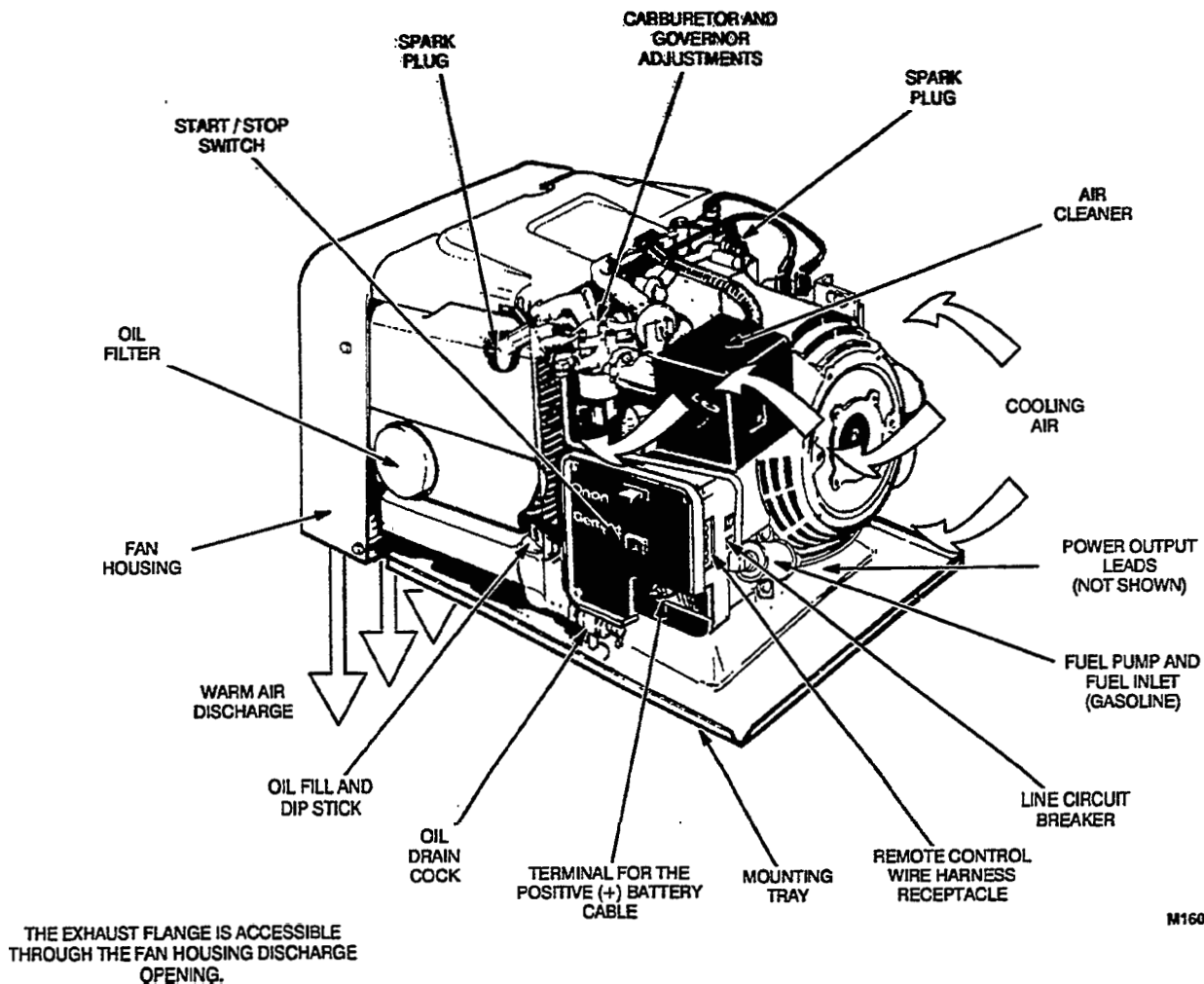
Maintenance and Service Access

The set should be removable for service without having to remove other equipment on the vehicle. The enclosure or compartment must be removable or have access doors and there must be enough clearance between the set and other equipment and bulkheads to perform the following maintenance:

- Checking the oil level
- Adding oil
- Draining oil

- Changing the oil filter
- Changing the air filter element
- Changing both spark plugs
- Adjusting the carburetor
- Adjusting the governor
- Starting and stopping the set
- Resetting the line circuit breaker.

See Figure 3-3 to locate these points.



M1604-10s

FIGURE 3-3. TYPICAL GENERATOR SET

ENCLOSURE VENTILATION

The set has an air cooled engine. The air that is drawn through the generator and across the engine cooling fins is discharged downwards through the bottom of the fan housing (Figure 3-3). See the appropriate outline drawing (Section 9.) for the location and size of the opening required if the set is mounted on a floor. A splash shield or acoustic baffle or the surface above which the set is mounted must not be located closer than 2 inches (51 mm) to the air discharge opening (Figures 3-1 and 3-2).

The air inlet of the enclosure or compartment must have at least 85 square inches (548 square centimetres) of free area. (Subtract the total area blocked by the decorative grill when calculating the free area.) The inlet must draw air from the sides or front of the vehicle—not from the rear of the vehicle or from below. The opening should be located as high as possible in the enclosure or compartment to promote convective cooling when the set is shut down.

⚠ CAUTION *Drawing ventilating air from the rear of the vehicle or from below can cause recirculation of the hot air discharged from the set, causing high compartment air temperatures that can disable the set.*

See Section 8. Checks, Start-Up, Break-in and Tests for instructions concerning the enclosure temperature test.

ACOUSTICS

Sets rated 4.5 kW have a 72 dBA noise rating. Sets rated 6.5 kW have a 74 dBA noise rating. These ratings are at 10 feet (3 metres) and are exclusive of exhaust noise. The exhaust accessory kit (See Section 4. Exhaust System) includes a muffler with a 23 dBA noise attenuation rating.

Noise can be further reduced by lining the enclosure or compartment with acoustic insulation, by reducing the number and size of openings to the minimum required for ventilation and by baffling the openings to reduce line-of-sight noise (Figure 3-2). Acoustic insulation should be 1/2 to 1 inch (13 to 25 mm) thick and have a 250° F (121° C), "Self-Extinguishing" fire hazard classification. The compartment must be sized so that at least the minimum clearance of 5/8 inches (15 mm) is obtained between the set and the insulation.

⚠ WARNING *Because of the hot surfaces of the set, clearances of less than 5/8 inches (15 mm) or use of insulation not having a 250° F (121° C) "Self-Extinguishing" fire hazard classification can lead to ignition of the insulation, causing severe personal injury, death or damage to the equipment.*

Section 4. Exhaust System

The exhaust system must be laid out and constructed carefully to prevent the entrance of exhaust gases into the cab or work-spaces of the vehicle. Figures 4-1, 4-2 and 4-3 illustrate typical exhaust system layouts with the exhaust accessory kits available for these sets.

⚠ WARNING *Exhaust gas is deadly. The exhaust system must discharge all engine exhaust away from the vehicle, and it must not leak. Follow these instructions carefully and use only the appropriate Onan®-supplied exhaust accessory kit.*

MUFFLER

The spark-arrest muffler supplied in the exhaust accessory kit is approved by the U.S. Forest Service and meets many installation codes. Failure to install and maintain a spark-arrest muffler may violate the law. The muffler also has a 23 dBA noise attenuation rating.

Install the muffler exactly in accordance with the instructions in the the exhaust accessory kit selected for the installation.

⚠ WARNING *Liability for injury, death, damage, and warranty expense due to use of unapproved mufflers or to modifications becomes the responsibility of the person installing the unapproved muffler or performing the modification. Contact an Onan distributor for approved exhaust system parts.*

A clearance of at least 3 inches (76 mm) must be maintained between combustible material (wood, felt, cotton, organic fibers, etc.) and all parts of the exhaust system. The clearance may be reduced by shielding or by insulating the parts in accordance with the applicable installation codes. The temperature rise of adjacent combustible material must not exceed 117° F (65° C).

⚠ WARNING *The muffler and tailpipe get hot and can ignite combustible material closer than 3 inches (76 mm), leading to severe personal injury, death or damage to the equipment.*

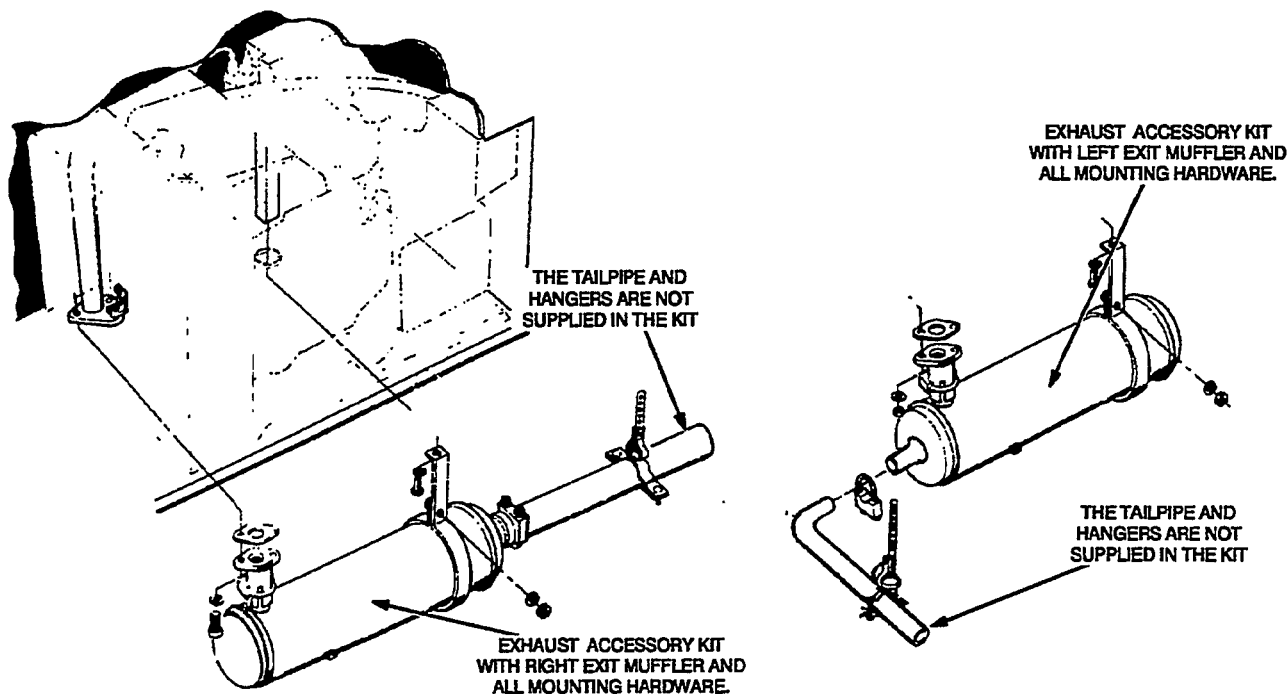


FIGURE 4-1. LEFT- AND RIGHT-EXIT EXHAUST ACCESSORY KITS FOR SETS MOUNTED DIRECTLY ON THE VEHICLE FLOOR OR ON A TAILGATE EXTENSION (THE MUFFLER AND TAILPIPE RUN BELOW THE FLOOR.)

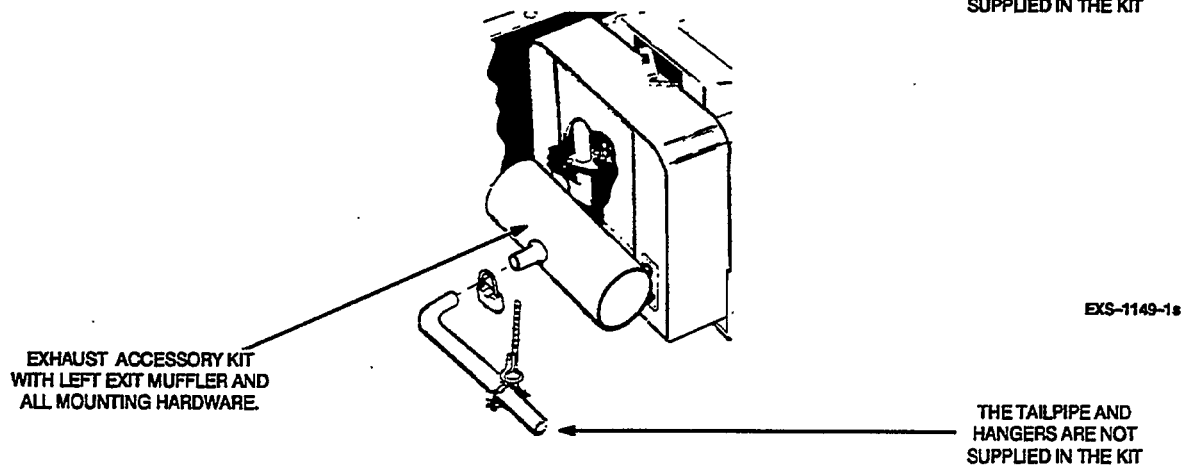
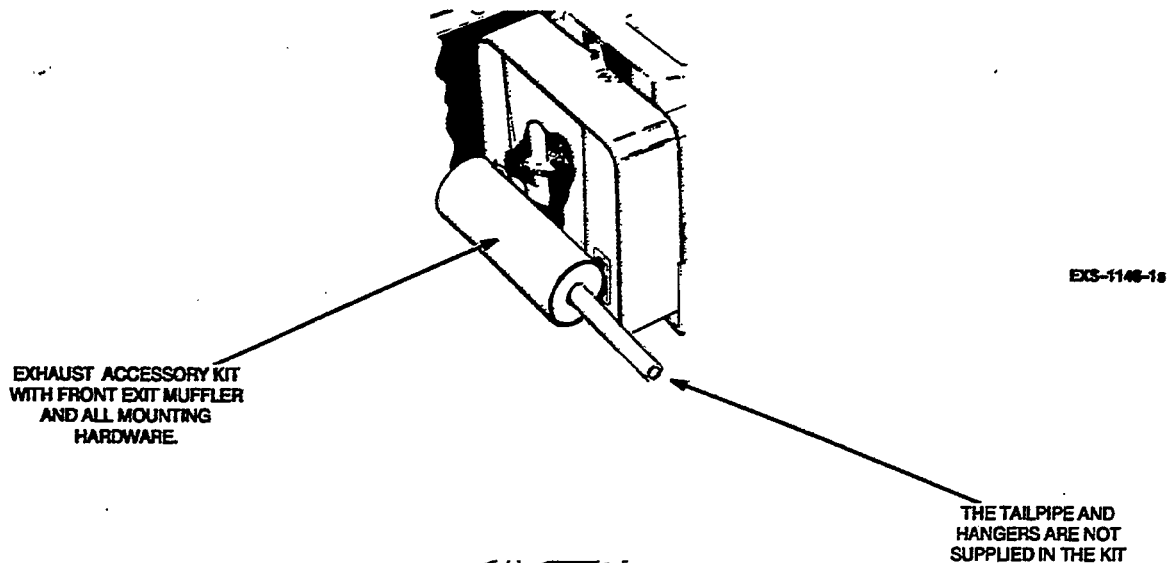
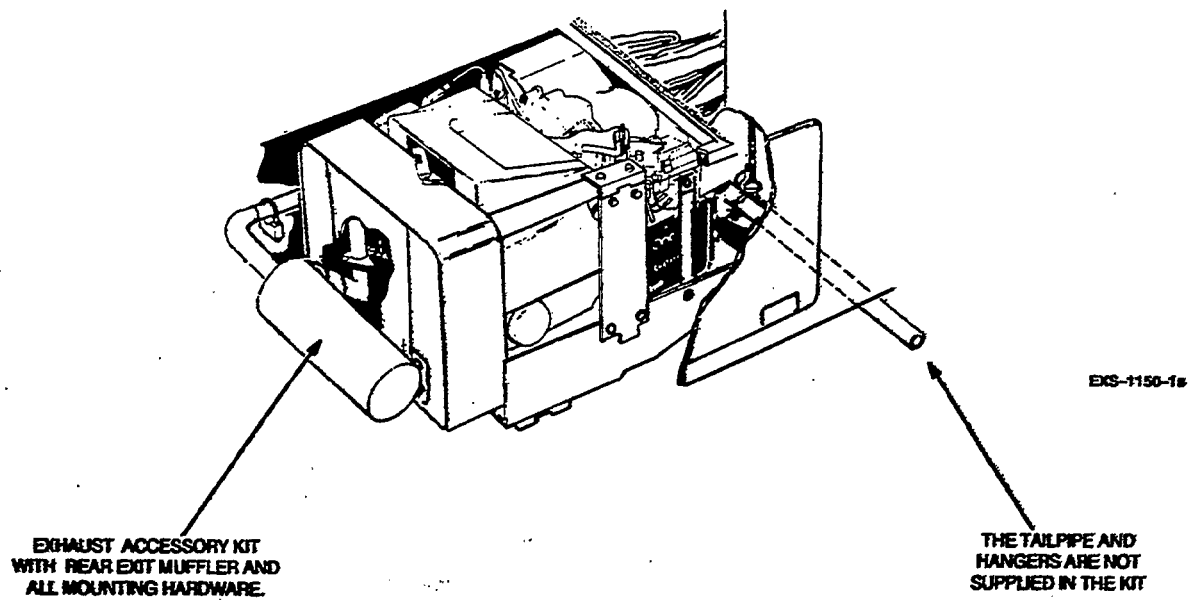


FIGURE 4-2. FRONT-, REAR- AND LEFT-EXIT EXHAUST ACCESSORY KITS FOR SETS MOUNTED UNDER THE VEHICLE FLOOR OR ON TOP OF TOOL CABINETS OR AT ANOTHER ELEVATED POSITION ON THE VEHICLE

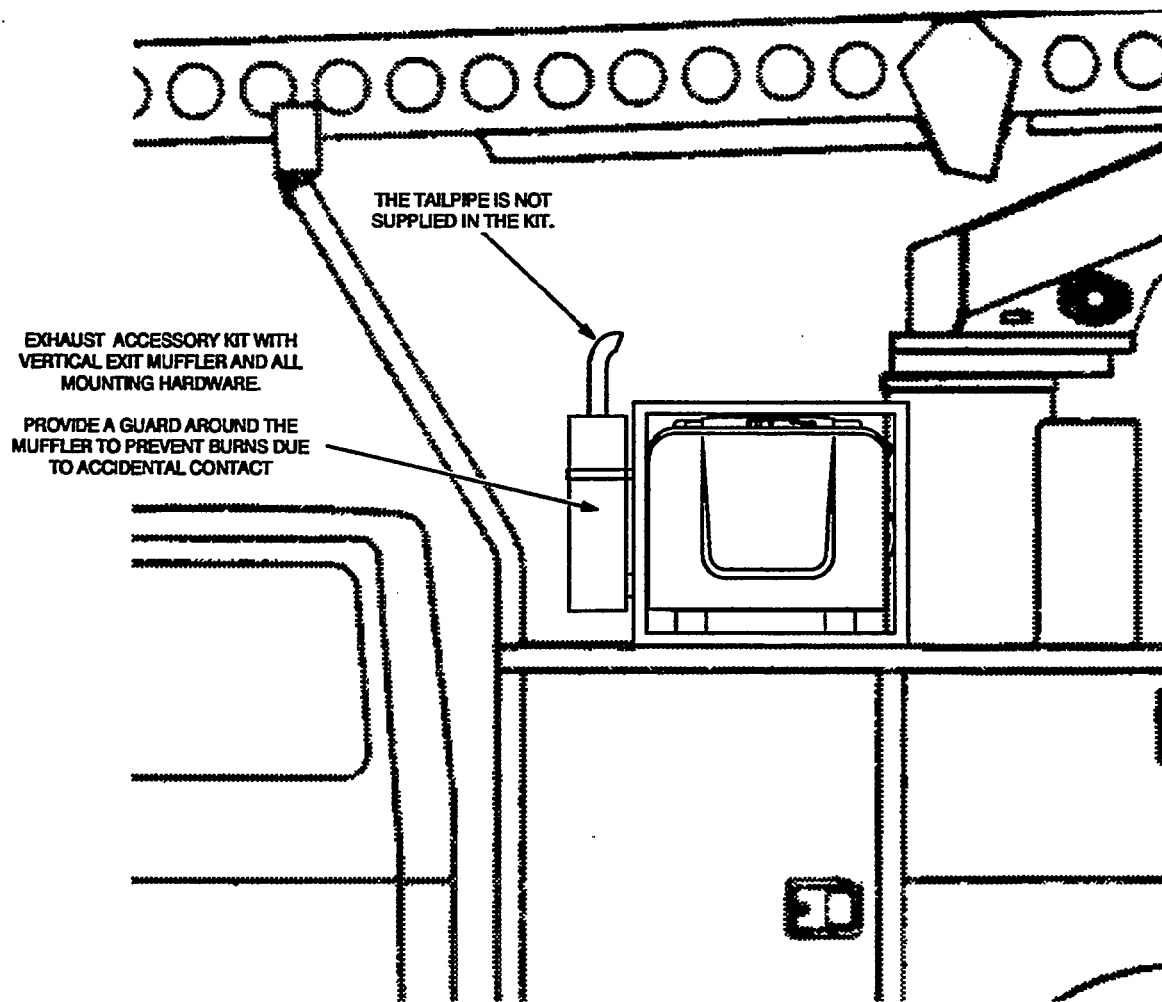


FIGURE 4-3. VERTICAL-EXIT EXHAUST ACCESSORY KIT FOR SETS MOUNTED ON TOP OF TOOL CABINETS OR AT ANOTHER ELEVATED POSITION ON THE VEHICLE.

EXHAUST TAILPIPE

The exhaust tailpipe must not terminate underneath the vehicle for any reason. It must extend at least 1 inch (25 mm) beyond the perimeter of the vehicle, exclusive of bumpers. It should also be supported at the perimeter to prevent it from being pushed up under the skirt of the vehicle.

Figure 4-4 shows the protected zones underneath the vehicle where the muffler and tailpipe may be routed, which are above the lower axle clearance line and the departure angle. Provide skid bars or other protection if the tailpipe has to be run outside this zone.

The tailpipe must not terminate near any openings such as vents, windows and doors that are not permanently sealed shut.

⚠ WARNING Exhaust gas is deadly. Do not terminate the exhaust system underneath the vehi-

cle or near openings into the vehicle, such as vents, windows and doors.

Terminate the exhaust tailpipe aft of the set if located on the same side of the vehicle and point it down and aft to prevent recirculation of exhaust.

Use 1-3/8 inch I.D., 18 gauge rigid steel tubing for the tailpipe.

Use 1-3/8 inch U-bolt muffler clamps and double rubber, U-shaped shock-mount hangers to support the tailpipe.

⚠ CAUTION Excessive exhaust back pressure can cause damage to the engine. A tailpipe deflector, if used, must be large enough to not cause backpressure.

⚠ CAUTION Do not Interconnect exhaust systems. Soot, high temperature and corrosive condensate can damage idle engines connected to a common exhaust system.

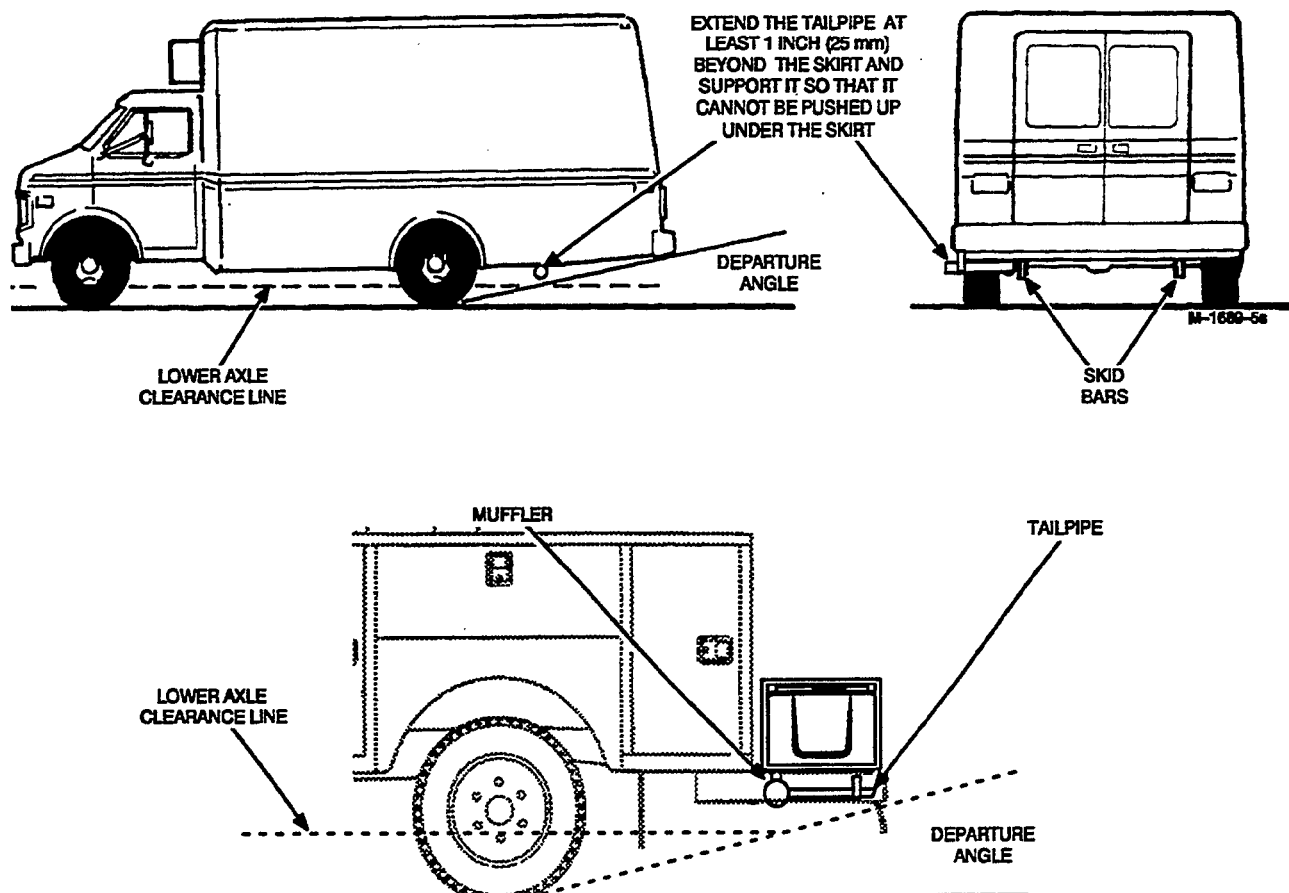


FIGURE 4-4. MUFFLER AND TAILPIPE ROUTING AND TERMINATION

Section 5. Fuel Systems

GASOLINE-FUELED SETS

Gasoline-fueled sets are designed for regular gasoline. See *Section 2. Specifications* regarding fuel consumption.

⚠WARNING *Gasoline is highly flammable and the vapors are explosive. Accidental ignition can lead to severe personal injury or death. Therefore, do not smoke near gasoline containers or equipment or when you smell gasoline. Keep all ignition sources well away—flames, sparks, pilot lights, arc-producing equipment, etc.*

An electric fuel pump is mounted on the set (Figure 5-1). It delivers fuel to the carburetor at 4 to 5 psi (28 to 35 kPa) and has a lift capacity (suction) of 3 feet (0.9 metres).

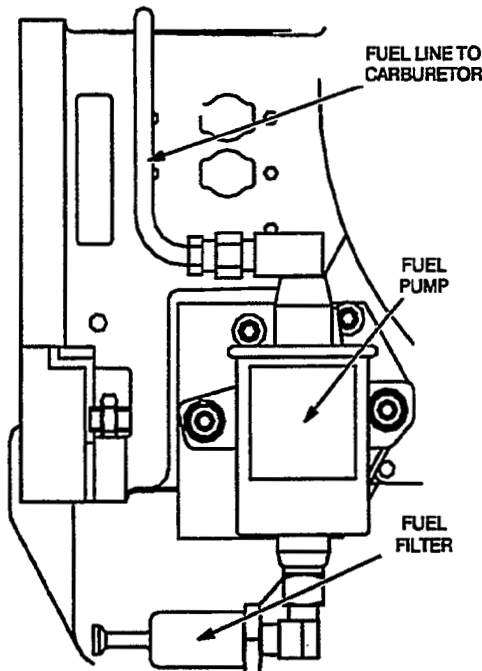


FIGURE 5-1. FUEL PUMP AND FILTER

Fuel Supply Line

Connect the set to the fuel supply line with approved flexible fuel hose to take up the movement allowed by the vibration isolators. The hose must be non-metallic (non-conductive) so that it does not become an alternative path for cranking current.

The fuel supply line should be seamless steel tubing with approved flare fittings. It should be run

above the tank to prevent siphoning if the line breaks and away from hot exhaust parts to prevent vapor lock. It should be supported and protected to prevent chaffing, kinking and pinching. It must be accessible throughout its length for inspection and replacement.

⚠WARNING *Electric sparks can ignite gasoline, causing a fire that could lead to severe personal injury or death. Therefore, run electrical wiring and fuel lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Fuel Tanks and Supply Pressure

A separate fuel pickup tube for the generator set is recommended when using the vehicle fuel supply tank. The fuel pickup tube for the set should extend down into the fuel supply tank only so far as will leave a quarter-tank of fuel for the vehicle engine.

Fuel pressure greater than 6 psi (41 kPa) at the carburetor fitting can cause flooding. It should be noted that in most cases the fuel pump for the vehicle engine puts both the fuel supply line and the fuel return line under high pressure (up to 40 psi) when the engine is running. If the set is connected to the vehicle engine fuel line, fuel pressure in the line to the set must be regulated to 6 psi (41 kPa) or less. The Fuel Pressure Test under *Section 8. Checks, Start-Up, Break-In and Tests* is recommended for every installation.

⚠WARNING *Carburetor flooding can cause poor performance, lead to serious engine damage and cause a fire leading to severe personal injury or death. Fuel pressure at the carburetor fitting must not exceed 6 psi (41 kPa) under any operating condition.*

Federal standards for vehicle fuel tanks may require the installation of a fuel shutoff solenoid valve at the fuel pickup tube to prevent leakage in the event of a roll-over.

Also, federal standards for vehicle impact, roll-over and emissions may be applicable when an auxiliary fuel tank is provided for the generator set. Check with the vehicle chassis manufacturer regarding these standards.

Remounting the Fuel Pump

If the set is mounted at an elevated location above the lift capacity of the fuel pump (3 feet [0.9 metres]), remount the pump as follows.

1. Remove the control panel and disconnect the fuel pump lead from the quick-connect connector in the control box.
2. Unbolt the pump from the set and bolt it to the vehicle chassis at a location that is within a vertical distance of 3 feet (0.9 metres) of the bottom of the fuel pickup tube in the tank. It should be in a protected location. The ground wire eyelet should be secured under the head of one of the pump mounting bolts. Make sure there is a reliable ground path from the pump to the battery negative (–) terminal. Run a stranded copper conductor of at least No. 18 AWG as a ground path, if necessary.

⚠ WARNING *Do not substitute an automotive fuel pump for the standard pump removed from the set. Other pumps can cause carburetor flooding because of the high pressures they develop. Carburetor flooding can cause poor performance and can lead to serious engine damage and to*

fire that could cause severe personal injury or death.

3. Run a stranded copper conductor of at least No. 18 AWG, between the set and the pump. Crimp the appropriate 1/4 inch quick-connect connector (male or female) on each end and connect between the connectors disconnected in Step 1. Secure the control cover.
4. It is recommended that a 30 micron fuel filter be installed at the inlet to the carburetor and a 50 to 80 micron filter ahead of the pump.
5. Federal standards for vehicle roll-over may require that a fuel shutoff solenoid valve be installed at the fuel pickup tube to prevent fuel leakage in the event of a roll-over. Wire the solenoid in parallel with the fuel pump. (Roll-over will cause the engine to lose oil pressure, leading to safety shutdown and closing of the fuel valve.) Use a listed electric safety shutoff valve marked suitable for gasoline. It must have a 12 VDC, 1 amp (or less) coil rating. See the appropriate wiring diagram in *Section 9. Outline Drawings and Wiring Diagrams*.
6. Run the Fuel Pressure Test in accordance with *Section 8. Checks, Start-Up, Break-In and Tests*.

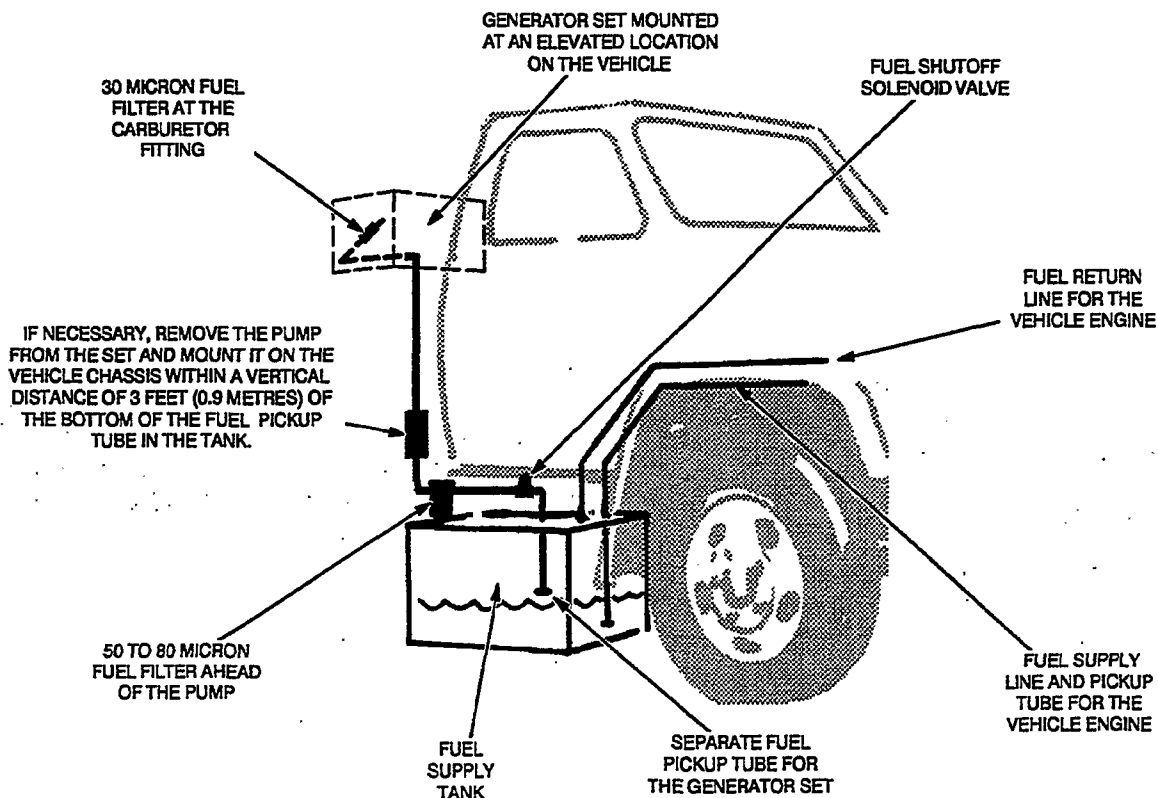


FIGURE 5-2. TYPICAL FUEL SYSTEM

PROPANE-FUELED SETS—LIQUID WITHDRAWAL

Figure 5-3 illustrates the fuel handling parts of a propane-fueled set equipped for liquid withdrawal of propane and a typical supply system. The set can use commercial propane or HD-5 grade LPG consisting of at least 90 percent propane. Fuel consisting of more than 2.5 percent butane will cause hard starting when ambient temperatures are below freezing. See *Specifications* regarding fuel consumption.

Because variations in fuel, altitude and ambient temperature affect performance, it might be necessary to make governor and fuel mixture adjust-

ments once the set has been installed. See the Service Manual.

⚠WARNING *Propane is highly flammable and explosive. Accidental ignition can lead to severe personal injury or death. Therefore, do not smoke near gas tanks or equipment or when you smell gas. Keep all ignition sources well away—flames, sparks, pilot lights, arc-producing equipment, etc.*

The installation, testing and inspection of the gas supply system must be performed by qualified persons in accordance with the applicable codes.

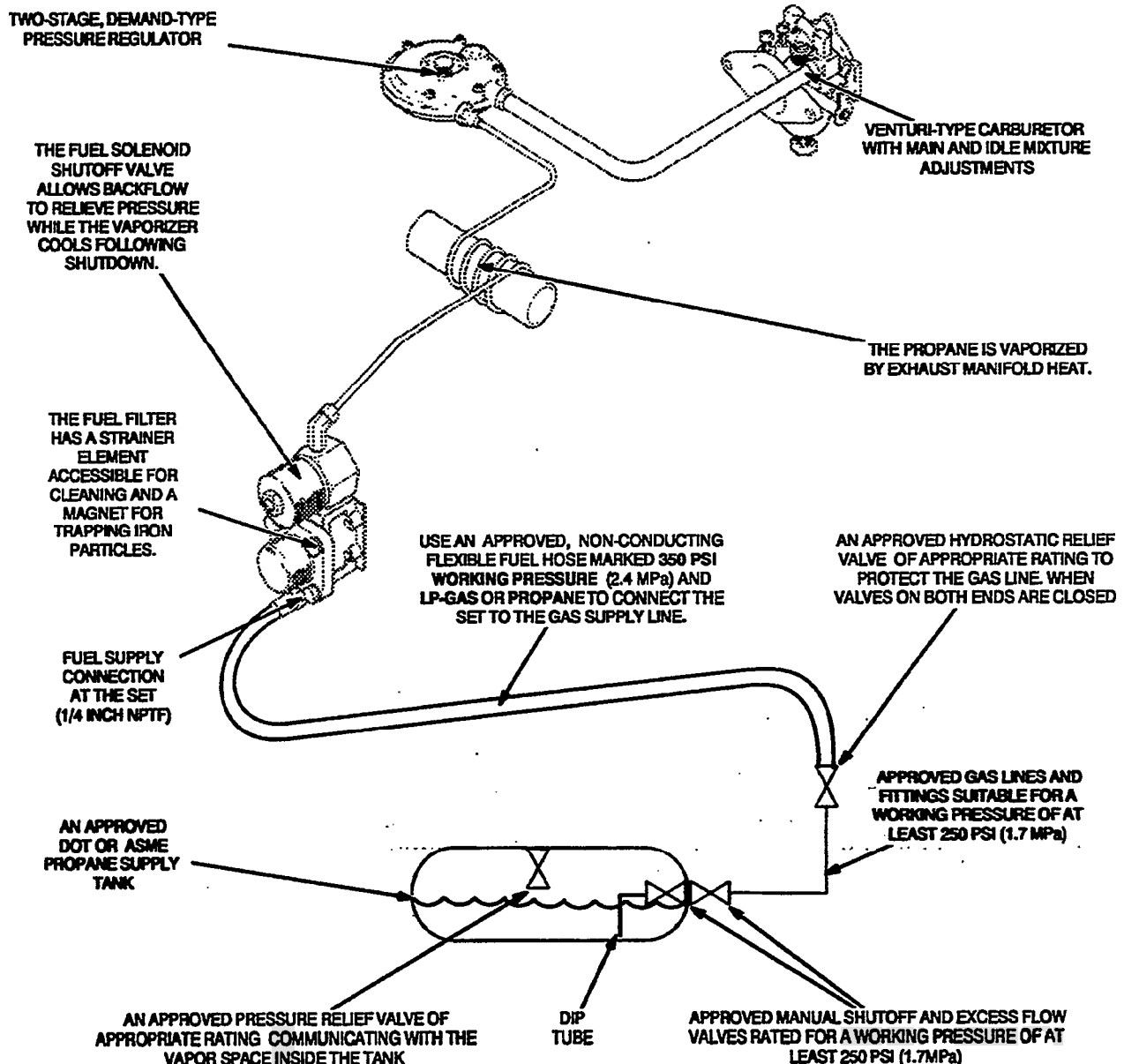


FIGURE 5-3. TYPICAL PROPANE FUEL SYSTEM—LIQUID WITHDRAWAL

It is recommended that Section 3-6 (Engine Fuel Systems) of the Standard for the Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58) be used as a guide for the installation of the propane fuel system.

To take up the movement allowed by the vibration isolators, the set must be connected to the fuel supply line with approved flexible fuel hose marked **350 PSI Working Pressure** (2.4 MPa) and **LP-Gas or Propane**. The hose must be non-conductive between the end connectors so that it cannot become an alternative path for cranking current.

Gas lines should be routed away from hot exhaust parts and electrical wiring, be supported and protected to prevent chaffing, kinking and pinching and be accessible throughout for inspection and replacement.

⚠WARNING *Electric sparks can ignite propane, causing a fire that could lead to severe personal injury or death. Therefore, run electrical wiring and gas lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Upon completing the installation, fill the propane tank and test every joint and fitting in the propane supply system using an approved method, such as soap bubbles.

⚠WARNING *Testing for gas leaks with a flame can cause a fire or explosion that could lead to severe personal injury or death. Use approved methods only.*

PROPANE-FUELED SETS—VAPOR WITHDRAWAL

Figure 5-4 illustrates a propane-fueled set equipped for vapor withdrawal of propane and a typical installation of the pressure regulator and gas solenoid, which are supplied in a kit. The set can use commercial propane or HD-5 grade LPG consisting of at least 90 percent propane. Fuel consisting of more than 2.5 percent butane will cause hard starting when ambient temperatures are below freezing. See *Specifications* regarding fuel consumption.

Because variations in fuel, altitude and ambient temperature affect performance, it might be neces-

sary to make governor and fuel mixture adjustments once the set has been installed. See the Service Manual.

⚠WARNING *Propane is highly flammable and explosive. Accidental ignition can lead to severe personal injury or death. Therefore, do not smoke near gas tanks or equipment or when you smell gas. Keep all ignition sources well away—flames, sparks, pilot lights, arc-producing equipment, etc.*

The installation, testing and inspection of the gas supply system must be performed by qualified persons in accordance with the applicable codes.

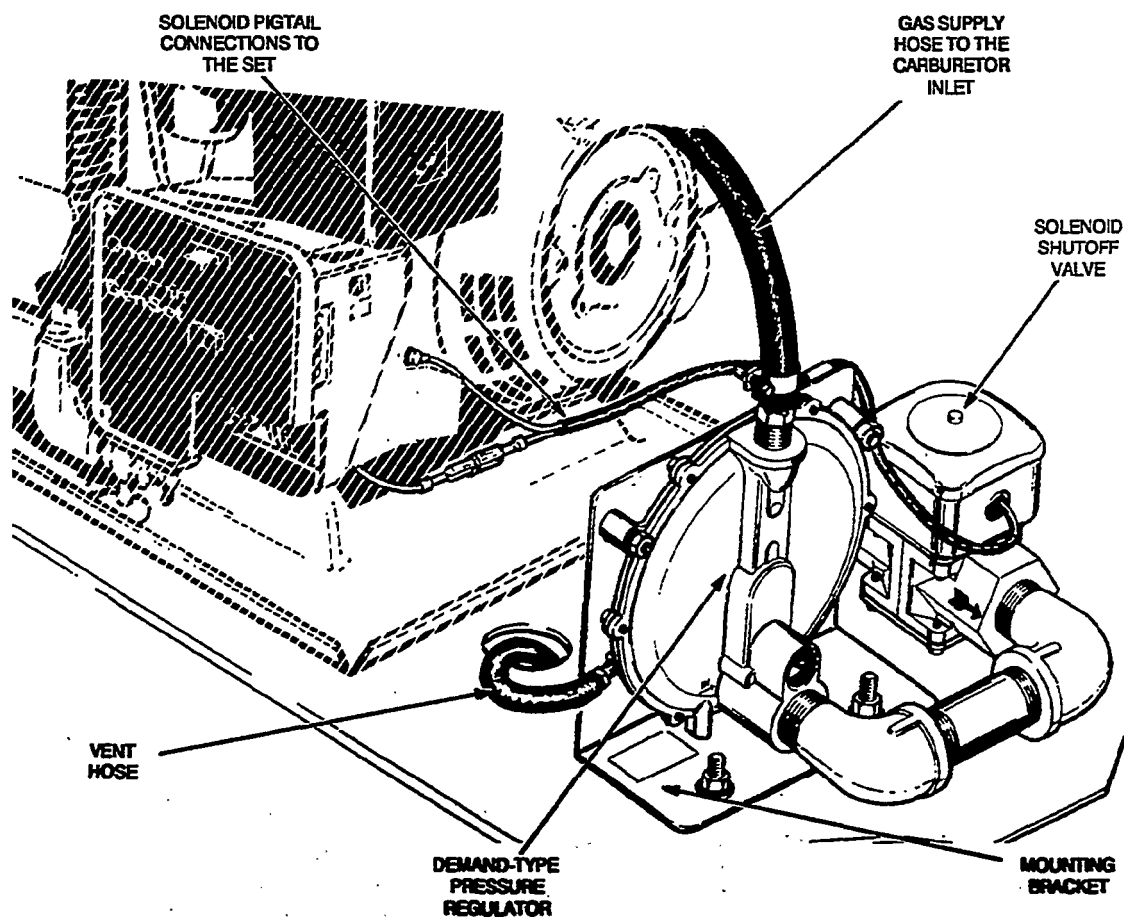


FIGURE 5-4. TYPICAL INSTALLATION OF THE DEMAND PRESSURE REGULATOR AND FUEL SOLENOID SHUTOFF VALVE

It is recommended that Section 3-6 (Engine Fuel Systems) of the Standard for the Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58) be used as a guide for the installation of the propane fuel system.

Install the gas pressure regulator and solenoid valve exactly in accordance with the instructions in the kit.

Adjust the gas supply pressure (at the gas inlet of the pressure regulator) to at least 7 inches (178 mm) Water Column (WC). The pressure must not exceed 14 inches (356 mm) WC.

⚠ CAUTION *High gas supply pressure can damage the sensitive demand-type pressure regulator and lead to poor engine performance.*

Gas lines should be routed away from hot exhaust parts and electrical wiring, be supported and protected to prevent chaffing, kinking and pinching and

be accessible throughout for inspection and replacement.

⚠ WARNING *Electric sparks can ignite propane, causing a fire that could lead to severe personal injury or death. Therefore, run electrical wiring and gas lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Upon completing the installation, fill the propane tank and test every joint and fitting in the propane supply system using an approved method, such as soap bubbles.

⚠ WARNING *Testing for gas leaks with a flame can cause a fire or explosion that could lead to severe personal injury or death. Use approved methods only.*

Section 6. Electrical Connections

AC POWER OUTPUT CONNECTIONS

These sets are equipped with stranded No. 12 AWG pigtails for AC power output connections. The pigtails exit through a 1/2 inch trade size flexible conduit connector. See *Section 9. Outline Drawings and Wiring Diagrams* for the applicable wiring diagram.

Wiring Methods

It is recommended that the National Electrical Code (NFPA No. 70) be used as a guide for all AC wiring on the work vehicle. Also, there may be Local codes that apply to a stationary installation.

Special consideration should be given to the following items.

1. The flexible conduit run to the set must have enough slack and be routed such that it does not interfere with free movement of the set on its vibration isolators.
2. Rain-tight conduit, fittings and junction boxes should be used for all external wiring.
3. Ground fault circuit interrupters (GFCI) should be used for all branch circuits with convenience power receptacles.
4. Where wiring enters the cab or work-space, seal the opening, inside and outside the wiring conduit, to keep exhaust gas from entering.

⚠ WARNING *Exhaust gas is deadly. Where wiring enters the cab or work-space, seal the opening, inside and outside the wiring conduit, to keep exhaust gas from entering.*

5. AC wiring and fuel lines must be run as far apart as possible.

⚠ WARNING *Electric sparks can ignite gasoline, leading to fire that could cause severe personal injury or death. Therefore, run electrical wiring and fuel lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Grounding

The generator set, power supply wiring and all connected electrical utilizing equipment must be bonded to a common grounding point in accordance with applicable codes or standards.

⚠ WARNING *Faulty grounding can lead to fire and electrocution, resulting in severe personal injury or death. The generator set must be properly grounded in accordance with applicable codes.*

Line Circuit Breakers

These sets are equipped with line circuit breakers to protect the generator. The breakers are mounted in the control box on most models. For models rated 380 volts and higher, the breakers are packaged in a kit for remote mounting.

⚠ CAUTION *For the warranty to apply, the generator must be protected from overcurrents and shortcircuits by the factory-provided line circuit breakers. Circuit breakers for remote mounting must be installed in accordance with the instructions in the kit.*

Vehicles and Stationary Installations With Utility Power Connections

For a stationary installation where the set is used for standby power, use an approved transfer switch to prevent the generator set and utility from being interconnected. If an Onan OT transfer switch is used, provide a 5 amp fuse in the B+ line between the transfer switch and the generator set. Install the transfer switch in accordance with its installation instructions.

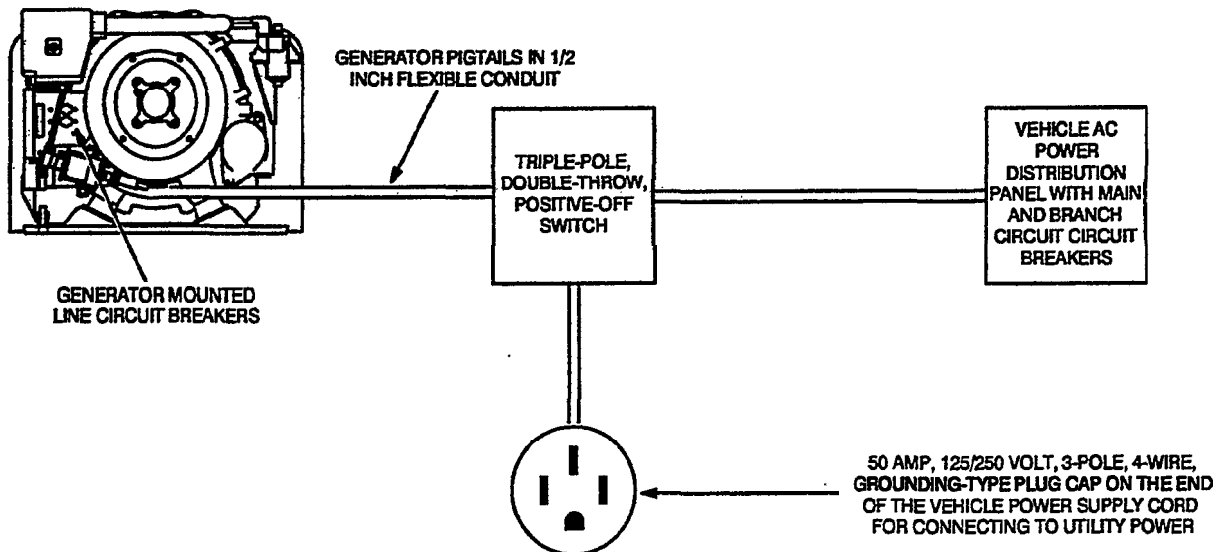
⚠ WARNING *Interconnecting the generator set with another source of power can lead to dangerous transient voltages, damage to the generator set and electrocution, resulting in severe personal injury or death. Use approved methods to keep the power sources separate.*

For a work vehicle equipped with a power supply cord for connecting utility power, provision must be made so that the generator set and utility cannot be interconnected. Recommended methods for single-phase, 120/240 volt generators include the following. See Figure 6-1.

1. A triple-pole, double-throw, positive-off switch having an appropriate electrical rating may be used for manually switching to the power source desired. All current carrying conductors must be switched.
2. For generators rated not more than 5 kW, the

leads may terminate in a 50 amp, 125/250 volt, 3-pole, 4-wire, grounded-type power receptacle and the cord from the vehicle power distribution panel in a matching plug cap. The vehicle power supply cord can then be connected for either utility or generator set power.

TRIPLE-POLE, DOUBLE-THROW, POSITIVE-OFF SWITCH FOR SELECTING POWER SOURCE



50 AMP, 125/250 VOLT, 3-POLE, 4-WIRE, GROUNDING-TYPE POWER RECEPTACLE AND PLUG-CAP FOR SELECTING POWER SOURCE

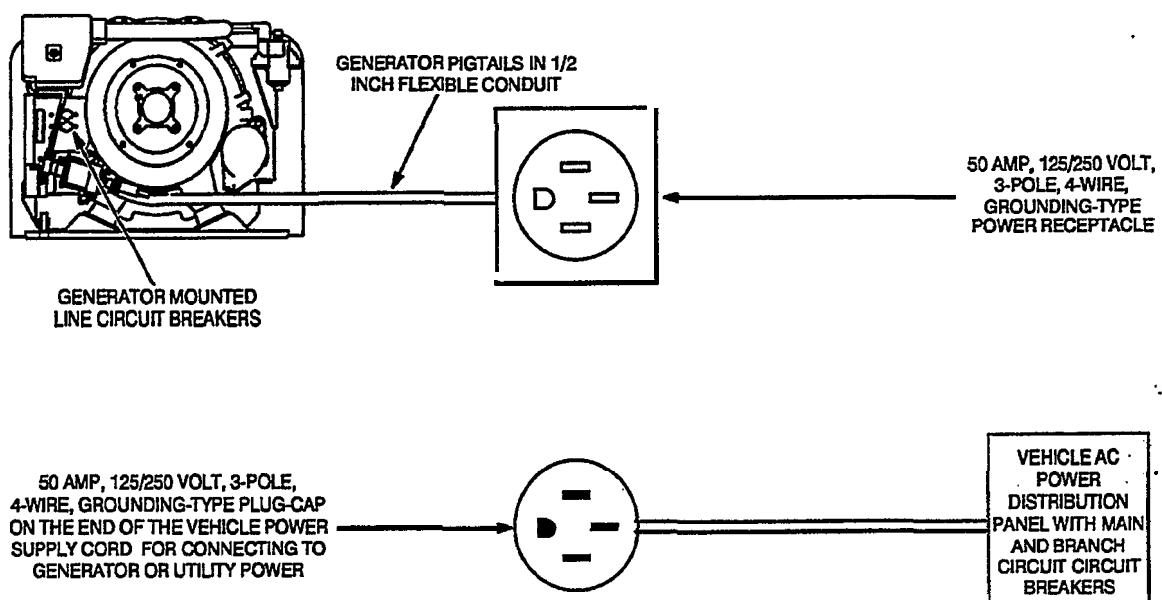


FIGURE 6-1. RECOMMENDED CONNECTIONS FOR A WORK VEHICLE WITH A SINGLE-PHASE GENERATOR AND A CORD FOR CONNECTING UTILITY POWER

DC CONNECTIONS

These sets have a 12 VDC, negative-ground engine control and cranking system. They are equipped with an automatic battery charging circuit. See *Section 2. Specifications* for the characteristics of the charging circuit.

Battery

A separate battery should be provided for the set. Battery capacity and battery cable size must be sufficient to obtain a minimum of 8 volts at the starter motor terminals during cranking under the coldest ambient temperatures expected. See *Section 2. Specifications* for the minimum battery requirements.

Battery Compartment

The battery must be mounted in a separate compartment from that of the set and away from spark-producing equipment. An enclosed compartment must have openings of at least 1.7 square inches (11 square centimetres) at the top and bottom for ventilation of battery gasses. It should be mounted such that spills and leaks will not drip acid on fuel lines, wiring and other equipment that could be damaged.

⚠WARNING *Arcing can ignite the explosive hydrogen gas given off by the battery, causing severe personal injury. The battery compartment must be ventilated and must isolate the battery from spark-producing equipment.*

Battery Cables

To prevent injury due to accidental start-up, do not connect the battery cables to the battery until the installation has been completed and it is time to start up the set. See Pre-Start Checks in *Section 8. Checks, Start-Up, Break-in and Tests*.

Cables should be run from both terminals of the battery to the generator set. It is not recommended

that the vehicle chassis frame be used as a path to the battery negative (–) terminal because of the high cranking currents involved. Size the cables in accordance with Table 6-1. Total cable length is the sum of the lengths of the positive (+) and negative (–) cables. In other words, total cable length will be approximately twice the distance between the battery and the set.

TABLE 6-1. BATTERY CABLE SIZES FOR AMBIENT TEMPERATURES DOWN TO –20 F (–29C)

TOTAL CABLE LENGTH FEET (METRES)	CABLE SIZE (AWG)
0 to 10 (0 to 3) 11 to 15 (3 to 4.5) 16 to 20 (4.5 to 6)	2* 0 000
* – No. 2 cable can be used for total cable lengths of up to 20 feet (6 metres) in warm climates.	

⚠WARNING *Electric sparks can ignite gasoline, leading to fire that could cause severe personal injury or death. Therefore, run the battery cables and fuel lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Connect the cable from the positive (+) terminal of the battery to the starter solenoid terminal. Provide a boot for the positive (+) battery terminal to prevent sparks if a tool is accidentally touched between the terminal and grounded metal parts.

Connect the cable from the negative (–) terminal of the battery to the grounding screw on the mounting tray.

Remote Control Wiring (Optional)

Two styles of remote control panel are available in kit form along with a plug-in wiring harness. The standard remote control panel includes a **Start/Stop** switch and **Run** indicator lamp. The deluxe remote control panel has these items plus an **Hour Meter** and a **Battery Condition Meter**. Install the control panel in accordance with the instructions in the kit.

Special consideration should be given to the following items.

1. Keep generator control wiring and AC wiring as far apart as possible. Alternating current can induce false signals in control wiring leading to erratic operation.

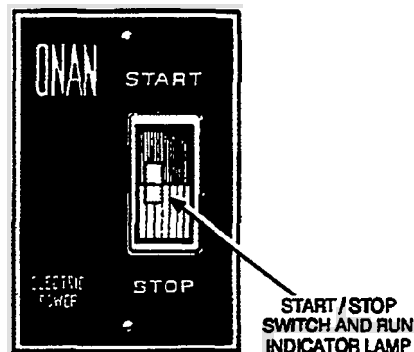
CAUTION *Keep generator control wiring and AC wiring as far apart as possible to prevent erratic operation due to false signals induced by the alternating current.*

2. Where wiring enters the cab or work-space, seal the opening, inside and outside the wiring conduit, to keep exhaust gas from entering.

WARNING *Exhaust gas is deadly. Where wiring enters the cab or work-space, seal the opening, inside and outside the wiring conduit, to keep exhaust gas from entering.*

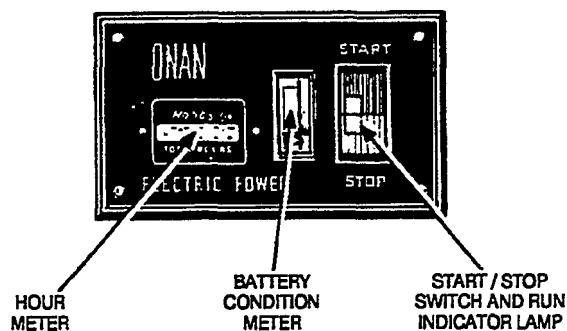
3. To connect a remote disarm switch, use stranded No. 16 AWG copper conductors. Connect as shown in the appropriate wiring diagram (Section 9).

STANDARD PANEL



CUT A 1-5/8 INCH (41.4 mm) HIGH BY 1-5/16 INCH (33.3 mm) WIDE OPENING FOR MOUNTING THE PANEL.

DELUXE PANEL



CUT A 2-3/8 INCH (60.3 mm) HIGH BY 4-1/8 INCH (104.8 mm) WIDE OPENING FOR MOUNTING THE PANEL.

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FIGURE 6-2. OPTIONAL REMOTE CONTROL PANELS

Section 7. Miscellaneous

EXTENDED SHAFT

As an option, these sets can be equipped from the factory with an extended generator shaft for driving auxiliary equipment at full engine power. The shaft and mounting flange conform to SAE J609A, flange B specifications.

The following must be considered during the installation.

1. The auxiliary loads must be disconnectable to allow for engine cranking without external loads.
2. A flexible coupling must be used to drive flange mounted equipment.
3. The shaft is designed for maximum side loading, as with belt sheaves, of 350 pounds (1558 N).
4. Flexible connections, such as hydraulic hose, must be used to take up the movement allowed by the vibration isolators.
5. The enclosure or compartment must be large enough to clear the auxiliary equipment or belt sheave by at least 5/8 inch (16 mm).

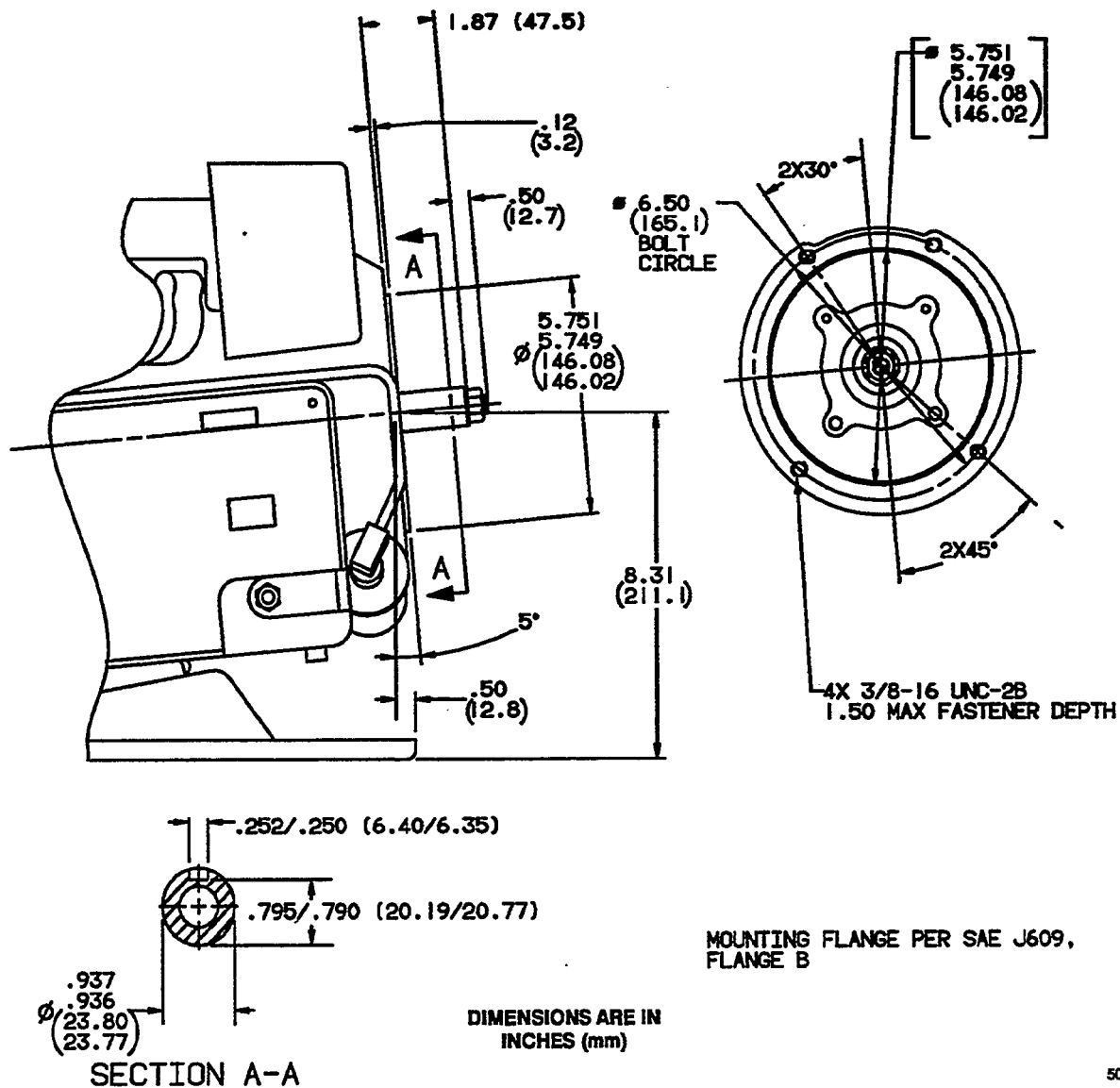


FIGURE 7-1. DETAILS OF THE EXTENDED SHAFT AND FLANGE

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Section 8. Checks, Start-Up, Break-In and Tests

PRE-START CHECKS

1. Follow the Installation Review at the end of this section. Do not continue on until each question can be answered with a "Yes."
2. Add engine oil. See the Operator's Manual.

⚠ CAUTION *The engine can be severely damaged if it is started without oil in the crankcase.*

3. Connect the battery. Always connect the positive (+) cable first, and then the negative (–) cable, when connecting a battery.

⚠ WARNING *Arcing can ignite the explosive hydrogen gas given off by the battery, causing severe personal injury. Arcing can occur when the negative (–) battery cable is connected first and the tool being used to connect or disconnect the the positive (+) battery cable accidentally touches the frame or other grounded metal part. Prevent arcing by always connecting the positive (+) battery cable first and disconnecting it last. Also, never disconnect the battery when the set is cranking or running.*

⚠ WARNING *Do not smoke near batteries. A cigarette can ignite the explosive hydrogen gas given off by the battery, causing severe personal injury.*

INITIAL START-UP

1. Push the Start/Stop switch to **START** and hold it there until the engine starts. The first start

might take extra cranking because it takes a few seconds to prime the fuel system. If the set does not start, see the *Troubleshooting Guide* in the Operator's Manual.

⚠ WARNING *Exhaust gas is deadly. Do not start and operate the generator set when the vehicle is parked inside a building.*

2. Check for fuel leaks as soon as the engine starts. Stop the set and fix fuel leaks immediately.

⚠ WARNING *Even the smallest gasoline leak can lead to fire or explosion in the vehicle, causing severe personal injury or death. Repair leaks immediately.*

3. Look and listen for exhaust system leaks. Repair exhaust leaks before putting the vehicle into service.

⚠ WARNING *Even the smallest exhaust leak can result in a deadly accumulation of exhaust gas in the vehicle. Repair exhaust leaks before putting the vehicle into service.*

5. Push the Start/Stop switch to **STOP**. The set should shut down.
6. If the installation has a remote control panel, repeat Steps 1 and 5 with the remote control switch.
7. After the genset starts, check the battery condition meter (if so equipped) for proper operation.

BREAK-IN

The vehicle should not be released for service without having performed this break-in procedure. Break-in reduces oil consumption, plug fouling and engine cylinder glazing. Break-in is vital for applications that involve extended periods of idling or operation under light load.

1. Start the set and let it run for two hours with half rated load.
2. Continue running the set for two more hours at three-quarters rated load.
3. Tag the set to indicate to the customer that break-in has already been accomplished in accordance with the Operator's Manual.

FUEL PRESSURE TEST

The vehicle should not be released for service without having conducted this test and having met the fuel pressure specification.

Method

1. Disconnect the fuel line at the outlet of the fuel pump and connect a pressure gauge at the pump outlet. A gauge calibrated for 0 to 15 psi (0 to 100 kPa) is recommended. Do not tee into the fuel line. This is a static pressure test.
2. Push the Start/Stop switch to **START** and hold it there for several seconds until the fuel pres-

sure stabilizes. Fuel pressure should stabilize between 3.5 and 6 psi (24 and 41 kPa).

3. Repeat the test with the vehicle engine running.

Fuel Pressure Specification

Normal fuel pressure is between 3.5 and 6 psi (24 and 41 kPa).

A fuel pressure greater than 6 psi (41 kPa) is not acceptable. Find out why the pressure is high. If it is high when the vehicle engine is not running, check to see that the proper Onan pump is being used. If it is high when the vehicle engine is running, a separate fuel pickup tube in the fuel tank will be required.

⚠WARNING *High fuel pressure can cause carburetor flooding. Carburetor flooding can cause poor engine performance and can lead to serious engine damage and to fire that could cause severe personal injury or death. Carburetor fuel inlet pressure must not exceed 6 psi (41 kPa) under any condition.*

If the fuel pressure is less than 3.5 psi (24 kPa), check for fuel restrictions in the system. The pump will have to be re-located closer to the fuel tank if it is located more than 3 feet (0.9 metres) above the end of the fuel pickup tube in the fuel tank. If the pump is defective, replace it with an identical Onan pump. The pump is not serviceable.

TEMPERATURE TEST

This test should be conducted on the first installation representative of a new application of the set. If necessary, the application should be modified and re-tested to meet the temperature specifications before production is continued.

Method

1. Conduct the test at a location where the ambient air temperature will remain between 60° F and 100° F (16° C and 38° C) during the test.
2. Use thermocouples not heavier than No. 24 AWG (0.21 mm²) to measure temperature. Locate them as indicated in Figure 8-1.
3. Use a load bank that can be adjusted to load the set to rated full-load.
4. Start the set, close all compartment doors and connect full-load.
5. Record temperatures at 15 minute intervals until they stabilize. Stable temperature is indicated when there is no change in temperature rise over ambient air temperature for three consecutive temperature readings at 15 minute intervals. See Table 8-1 for an example of how the data can be arranged for recording and analysis. (To determine temperature rises, subtract the ambient air temperature from the other temperatures in the same column in Table 8.1.)

Temperature Specifications

The rise in engine air inlet temperature over ambient air temperature must not exceed 8° F (4.4° C).

The rise in engine oil temperature over ambient air temperature must not exceed 190° F (106° C). Also, the oil temperature must not exceed 320° F (160° C).

The rise in compartment air temperature over ambient air temperature must not exceed 25° F (14° C).

High temperature rises indicate that warm discharged air is recirculating back into the engine compartment or that the inlet or outlet air openings are restricted. Find out why. Make whatever corrections are necessary to meet the specification. See *Section 3. Location, Mounting, Enclosure, Venting and Acoustics*.

TABLE 8-1. TEMPERATURE DATA

THERMOCOUPLE LOCATION	TEMPERATURE READING °F (°C)				
	TIME OF READING				
AMBIENT AIR TEMPERATURE					
ENGINE AIR INLET TEMPERATURE					
ENGINE OIL TEMPERATURE					
COMPARTMENT AIR TEMPERATURE					

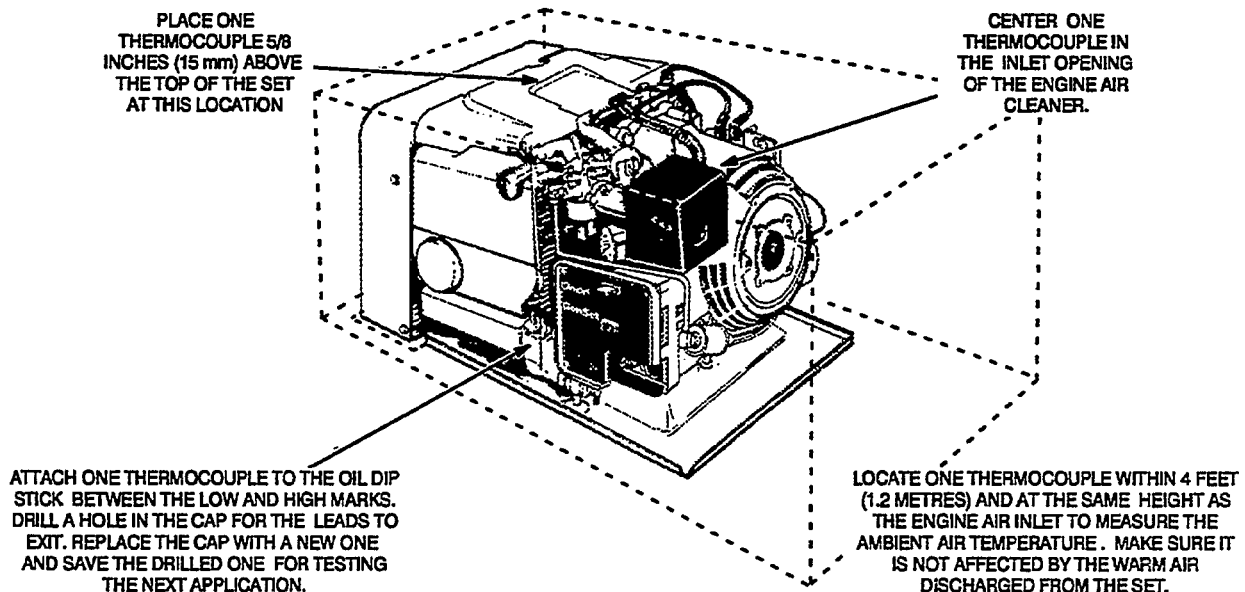


FIGURE 8-1. THERMOCOUPLE LOCATIONS FOR THE TEMPERATURE TEST

INSTALLATION REVIEW

Check each item below before the initial start-up. Make all corrections necessary in order to be able to answer "Yes" to each question.

Mounting and Enclosure

1. Does the installation allow 1/2 inch (13 mm) free movement of the generator set on its mounts?
2. Are there at least 2 inches (51 mm) between the warm air discharge opening and any air deflector or adjacent equipment below the opening?
3. Is the set protected from rain, snow, sun and road-splash?
4. Can the following routine maintenance be performed?
 - Checking the oil level
 - Adding oil
 - Draining oil
 - Adjusting the carburetor
 - Adjusting the governor
 - Starting and stopping the set from the control panel
 - Resetting the line circuit breaker
 - Changing the oil filter
 - Changing the air filter element
 - Changing both spark plugs
5. When required, are the compartment walls vapor-tight and fire-resistant?

Ventilation

1. Are there at least 85 square inches (548 square mm) of free air inlet to the compartment?
2. Is the cool air drawn from the side or front of the vehicle—not from the rear or from below?

Exhaust System

1. Is the muffler an approve Onan part?
2. Is the muffler supported in accordance with the instructions in the exhaust accessory kit?
3. Are all clamps, hangers and support straps in place in accordance with the instructions in the exhaust accessory kit?
4. Is combustible material properly protected where it runs closer than 3 inches (76 mm) to the muffler or tailpipe?
5. Is the tail pipe supported along its centerline and at its termination at the vehicle skirt by hanger straps with double U-shaped rubber isolators?
6. Does the tailpipe extend at least 1 inch (25 mm) beyond the perimeter of the vehicle and not terminate below a vent or openable door or window?

Fuel System

1. Are all fuel filters accessible for servicing?
2. Has a 30 micron filter been installed at the carburetor fitting?
3. Has a 50 to 80 micron filter been installed ahead of the fuel pump?
4. Is a flexible section of approved non-conducting fuel line installed between the fuel inlet and the fuel line from the tank?
5. Are all fuel connections and hose clamps tight?
6. Are fuel lines and electrical wires run separately?

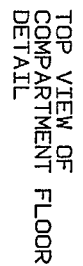
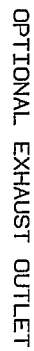
Electrical Systems

1. Are the power supply conductors run in conduit and properly supported?
2. Are wiring holes into the inside of the work-space (including the inside of AC conduit) sealed to prevent entrance of exhaust gas?
3. Are the battery and battery cables properly sized for the lowest ambient temperature?
4. Does a rubber boot cover the positive (+) battery cable terminal at the set?
5. Is full rated power from the set available through the vehicle power distribution panel?

Section 9. Outline Drawings and Wiring Diagrams

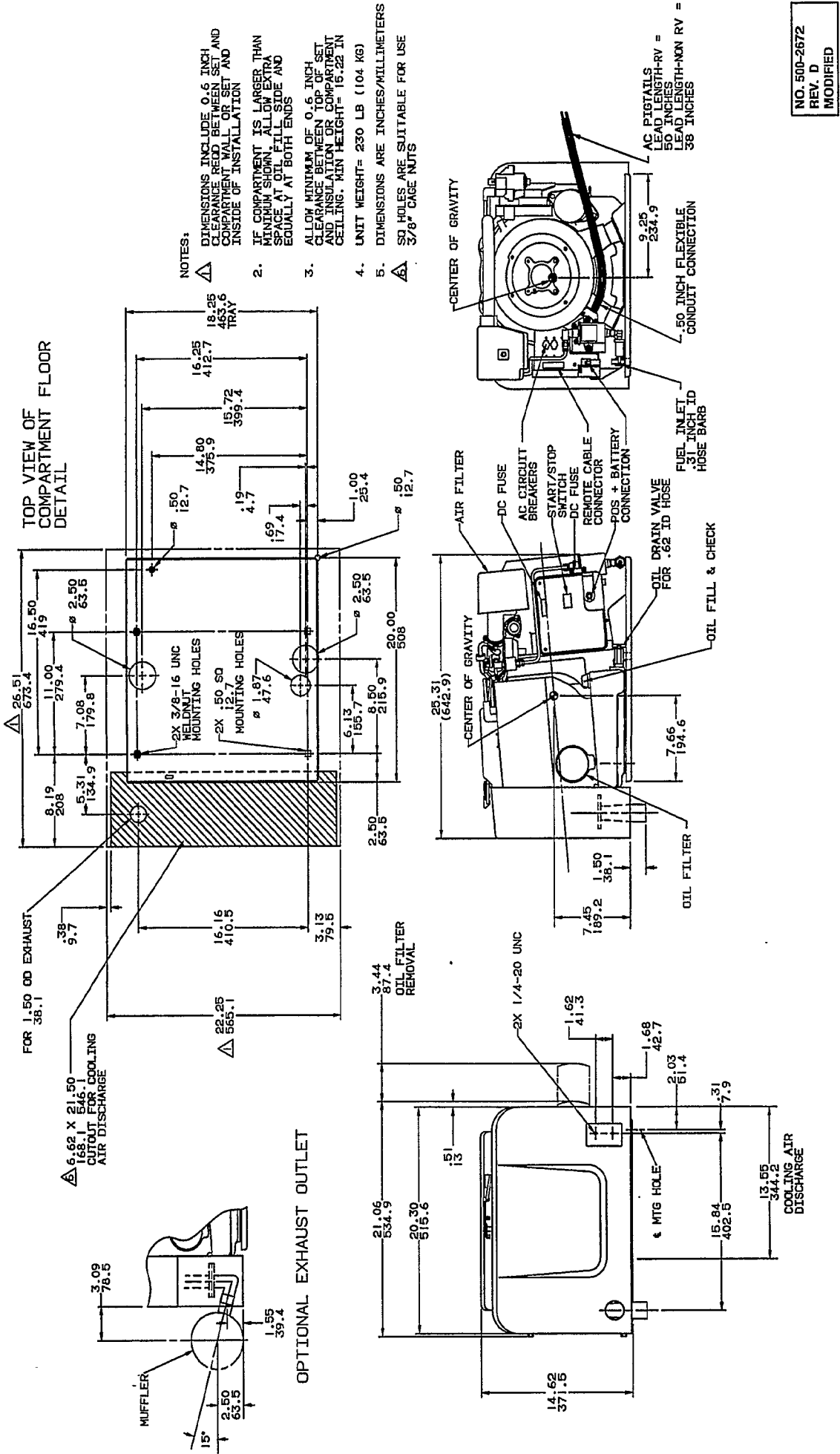
This section consists of the set outline drawings and wiring diagrams referenced in the text. The following drawings are included:

- Page 9-2—Outline Drawing for Gasoline-Fueled Model BGD Generator Sets
- Page 9-3—Outline Drawing for Gasoline-Fueled Model NHD Generator Sets
- Page 9-4—Outline Drawing for Propane-Fueled Model BGD Generator Sets
- Page 9-5—Outline Drawing for Propane-Fueled Model NHD Generator Sets
- Page 9-6—Wiring, Schematic and Connection Diagrams for Single-Phase, Gasoline-Fueled Model BGD and NHD Generator Sets
- Page 9-7—Wiring, Schematic and Connection Diagrams for Three-Phase, Gasoline-Fueled Model BGD and NHD Generator Sets
- Page 9-8—Wiring, Schematic and Connection Diagrams for Single-Phase, Propane-Fueled Model BGD and NHD Generator Sets



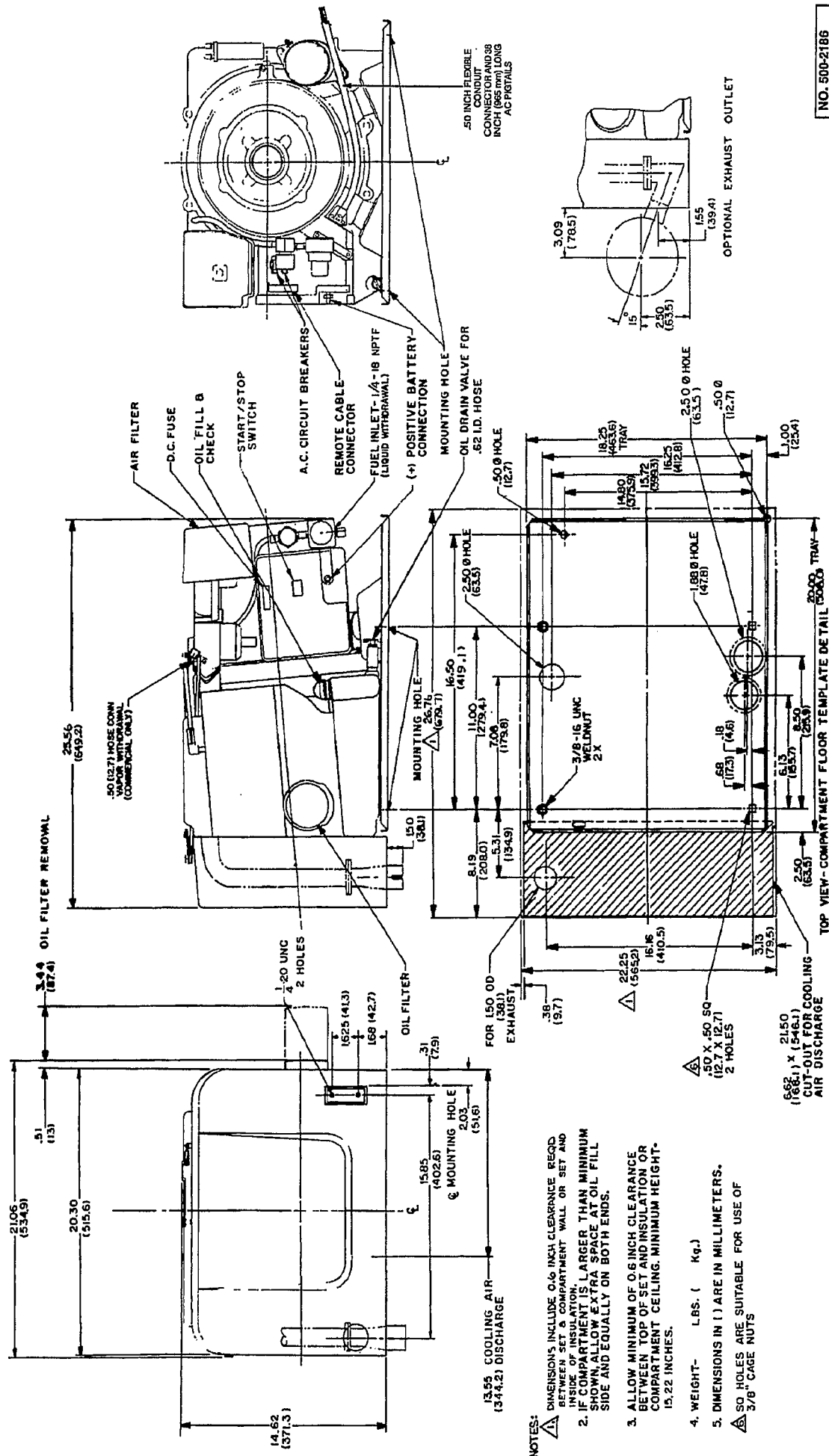
- AC PIGTAILS
LEAD LENGTH-RV =
50 INCHES
LEAD LENGTH-NON RV =
38 INCHES

NO. 500-2673
REV. D
MODIFIED



NO. 500-2672
REV. D
MODIFIED

OUTLINE DRAWING FOR GASOLINE-FUELED MODEL NHD GENERATOR SETS

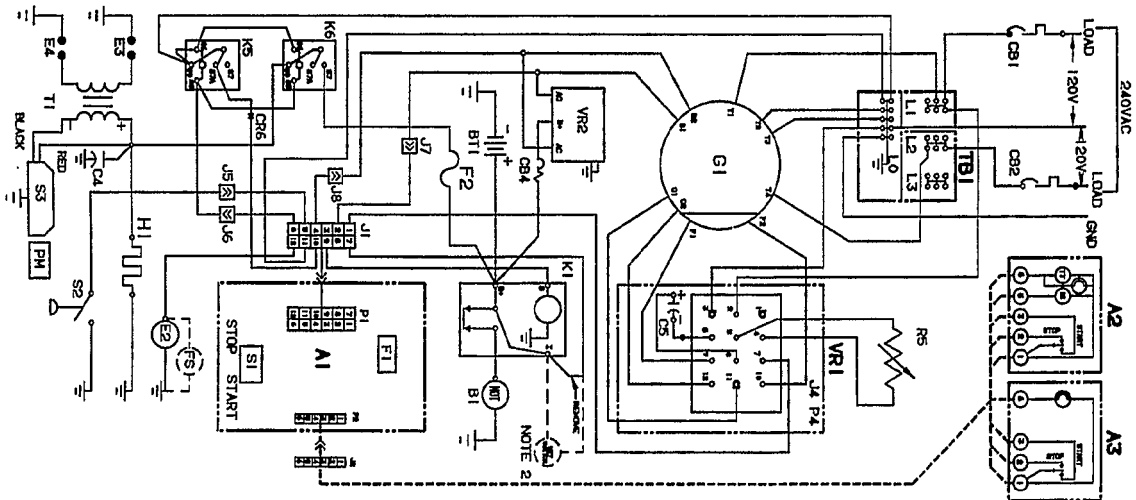


- NOTES:**
1. DIMENSIONS INCLUDE 0.6 INCH CLEARANCE REQD BETWEEN SET & COMPARTMENT WALL OR SET AND INSIDE OF INSULATION.
 2. IF COMPARTMENT IS LARGER THAN MINIMUM SHOWN, ALLOW EXTRA SPACE AT OIL FILL SIDE AND EQUALLY ON BOTH ENDS.
 3. ALLOW MINIMUM OF 0.6 INCH CLEARANCE BETWEEN TOP OF SET AND INSULATION OR COMPARTMENT CEILING. MINIMUM HEIGHT - 15.22 INCHES.
 4. WEIGHT- LBS. (Kg.)
 5. DIMENSIONS IN () ARE IN MILLIMETERS.
 6. 50 HOLES ARE SUITABLE FOR USE OF 3/8" CAGE NUTS

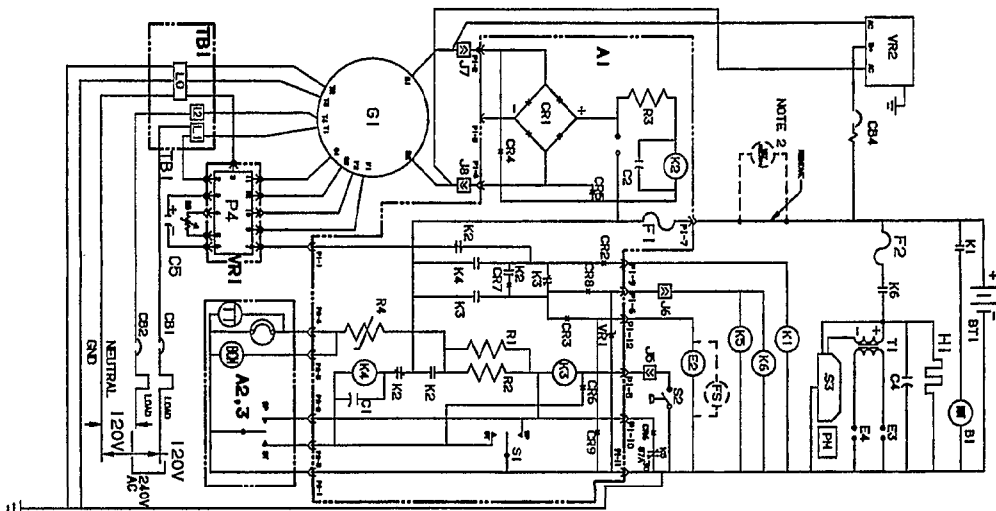
NO. 500-2186
REV. B
MODIFIED

OUTLINE DRAWING FOR PROPANE-FUELED MODEL NHD GENERATOR SETS

WIRING DIAGRAM



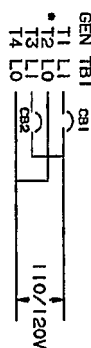
SCHEMATIC



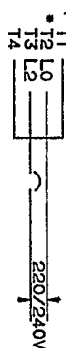
- NOTES:
1. *GROUNDED AC LEAD
 2. DISARM SWITCH BY CUSTOMER/INSTALLER NOT SUPPLIED BY ONAN. REQUIRES CONNECTING WITH NECESSARY EXTENSION LEADS FROM J1-6 TO KEY SWITCH AND CONNECTING FROM KEY SWITCH TO K1-1 AND DISCONNECTING LEAD AT K1-1. USE 16 GA CU WIRE.

WIRING, SCHEMATIC AND CONNECTION DIAGRAMS FOR SINGLE-PHASE, GASOLINE-FUELED MODEL BGD AND NHD GENERATOR SETS

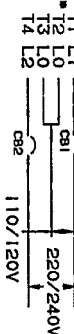
110-120 VOLTS 2 WIRE:
T3 TO TB1-L1; T4 TO TB1-L0; MOVE:
TB1-L2 TO CB2 T0; TB1-L1 TO CB2;
CONNECT OUTPUT LEADS (BLACK CB1 TO LOAD
AND CB2 TO LOAD) TOGETHER TO LOAD.



220 TO 240 VOLTS 2 WIRE:
T3 TO TB1-L1; T4 TO TB1-L0; TO CB1
TO OUTPUT LOAD LEAD (BLACK).



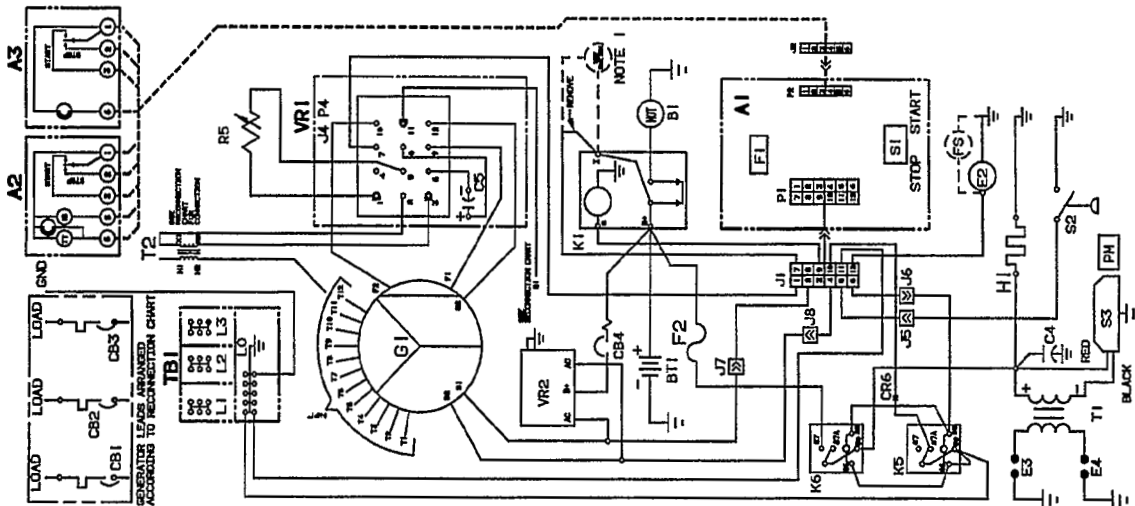
STANDARD CONNECTION DIAGRAM
(120/240 V, 3 WIRE),



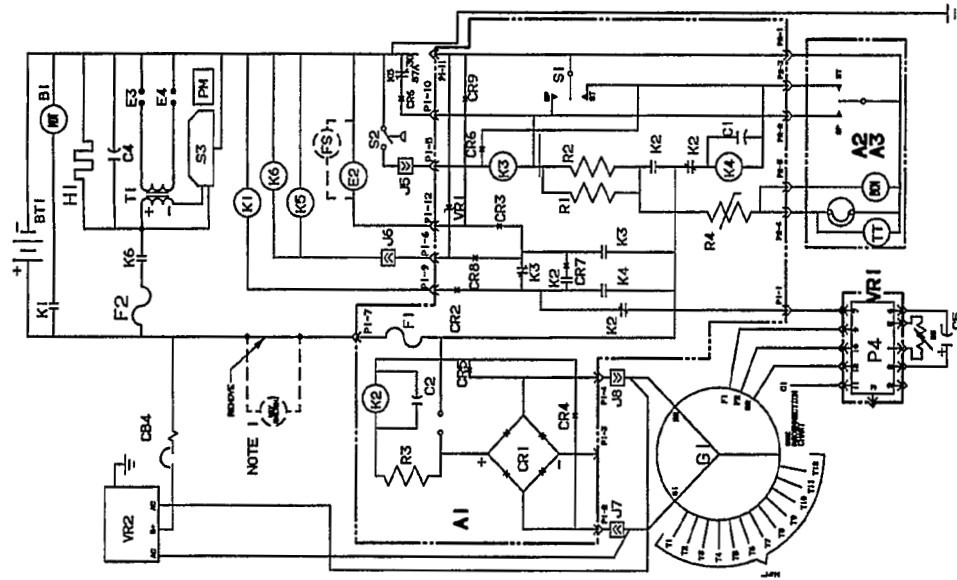
ITEM	DESCRIPTION OR PART NO.
VR2	VOLTAGE REGULATOR (DC)
VR1	VOLTAGE REGULATOR (AC)
T1	ION SOLE
S2	ION MODULE
S1	SWITCH-LOW OIL PRESS
K5,6	POTENTIOMETER
K1	RELAY-START SOLENOID
G1	GENERATOR
F1	CHOKE-GASOLINE ONLY
S3,4	FUSE-50N BLOW BA
E2	SPARK PLUGS
CR6	RECTIFIER
CB4	CIRCUIT BREAKER (THERMAL)
CB1,5	CIRCUIT BREAKER (AC OUTPUT)
CA,5	CAPACITOR
B1	BATTERY 12V
BT1	STARTER MOTOR
A2	REMOTE CONTROL-STANDARD
A1	REMOTE CONTROL-DELUXE
CONTROL	CONTROL

NO. 611-1215
REV B
MODIFIED

WIRING DIAGRAM

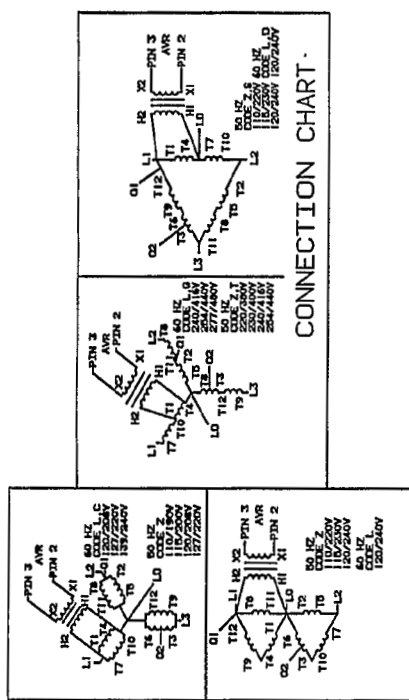


SCHEMATIC



NOTES:
1. DISARM SWITCH BY CUSTOMER/INSTALLER NOT SUPPLIED BY ONAN. REQUIRES CONNECTING WITH NECESSARY EXTENSION LEADS FROM J1-6 TO KEY SWITCH AND CONNECTING FROM KEY SWITCH TO K1-1 AND DISCONNECTING LEAD AT K1-1. USE 16 GA CU WIRE.

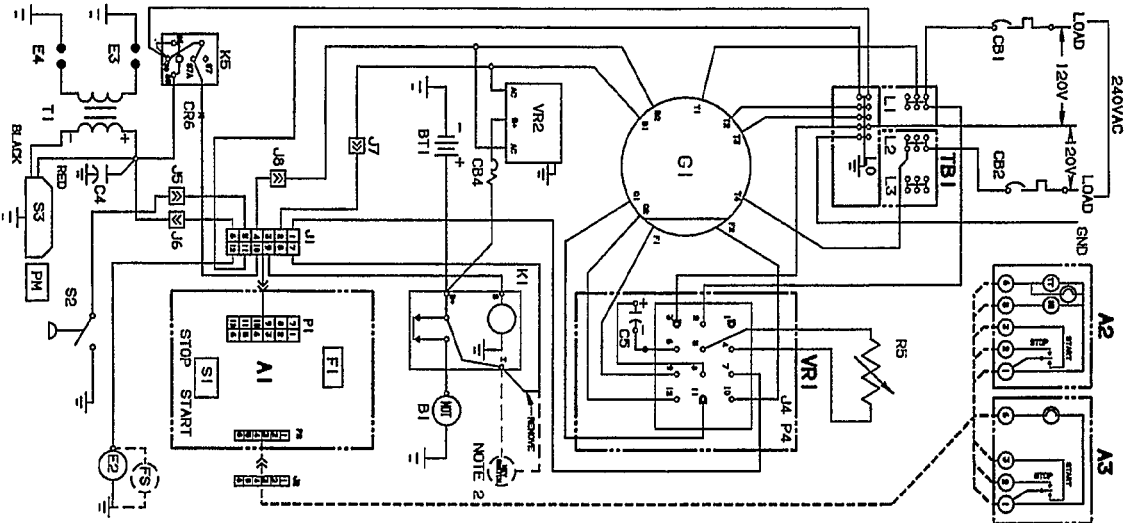
WIRING, SCHEMATIC AND CONNECTION DIAGRAMS FOR THREE-PHASE, GASOLINE-FUELED MODEL BGD AND NHD GENERATOR SETS



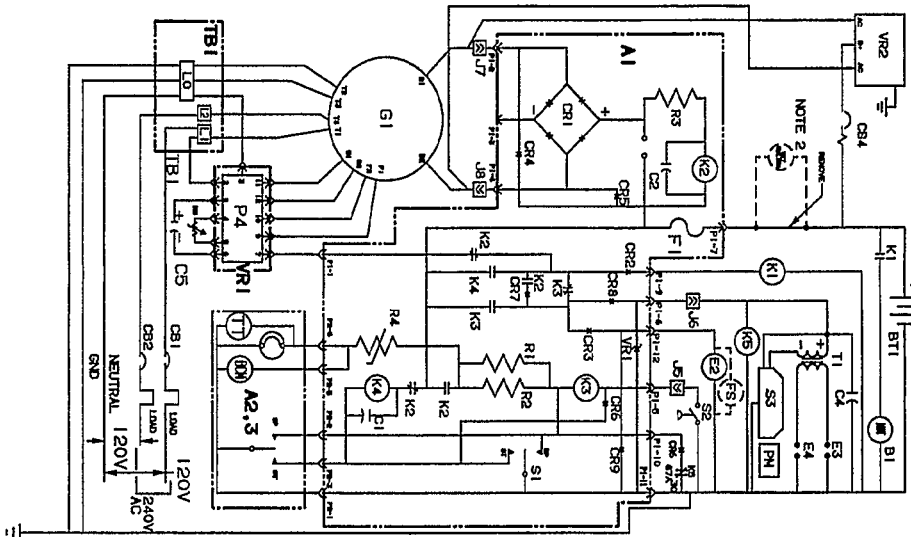
VR2	VOLTAGE REGULATOR (DC)
VR1	VOLTAGE REGULATOR (AC)
T1	TRANSFORMER VOLTAGE REG.
T2	IRON COIL
S2	SWITCH-LOW OIL PRESSURE
S1	POTENTIOMETER
K2	RELAY-START SWEND
K1	RELAY-START SWEND
SI	GENERATOR
FI	FUSE-SUN ALUM 5A
CS-4	SPARK PLUGS
E2	FUEL PUMP OR FUEL SOLENOID
CR6	RECTIFIER
CR4	CIRCUIT BREAKER (THERMAL)
WJ3	CIRCUIT BREAKER (AC BUTT/IT)
-4,5	CAPACITOR
BT1	BATTERY 12V
BT1	STARTER MOTOR
AS	REMOTE CONTROL-STANDARD
A2	REMOTE CONTROL-RELUXE
A1	CONTROL

NO. 611-1216
REV. B
MODIFIED

WIRING DIAGRAM



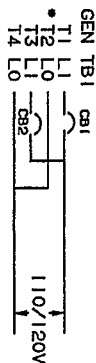
SCHEMATIC



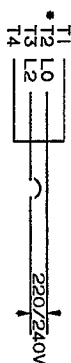
- NOTES:
1. *GROUNDED AC LEAD
 2. DISARM SWITCH BY CUSTOMER/INSTALLER NOT SUPPLIED BY OMAN. REQUIRES CONNECTING WITH NECESSARY EXTENSION LEADS FROM J1-6 TO KEY SWITCH AND CONNECTING FROM KEY SWITCH TO K1-1 AND DISCONNECTING LEAD AT K1-1. USE 16 GA CU WIRE.

WIRING, SCHEMATIC AND CONNECTION DIAGRAMS FOR SINGLE-PHASE, PROPANE-FUELED MODEL BGD AND NHD GENERATOR SETS

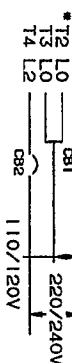
110-120 VOLTS 2 WIRE:
T3 TO TB1-L1; T4 TO TB1-L0; MOVE:
TB1-L2 TO CB2; TB1-L1 TO CB2; TO LOAD
CONNECT OUTPUT LEADS (BLACK CB2 TO LOAD
AND CB2 TO LOAD) TOGETHER TO LOAD.



220 TO 240 VOLTS, 2 WIRE:
T4 TO TB1-L1; REMOVE TB1-L1 TO CB1
TO OUTPUT LEAD (BLACK).



STANDARD CONNECTION DIAGRAM
(120/240 V, 3 WIRE):



SYM	DESCRIPTION OR MATERIAL
VR2	VOLTAGE REGULATOR (DC)
VR1	VOLTAGE REGULATOR (AC)
VR1	IGN COIL
S3	IGN MODULE
S2	SWITCH-LOW OIL PRESS
PS	POTENTIOMETER
KG	RELAY-START SOLENOID
K1	CHARGE-IGNITION ONLY
G1	GENERATOR
F1	FUSE-SLOW BLOW 5A.
E3,4	SPARK PLUGS
E2	FUEL PUMP OR FUEL SOL.
CR6	RECTIFIER
CB4	CIRCUIT BREAKER (THERMAL)
CB1,2	CIRCUIT BREAKER (AC OUTPUT)
CA,5	CAPACITOR
BT1	BATTERY 12V
B1	STARTER MOTOR
A3	REMOTE CONTROL-STANDARD
A2	REMOTE CONTROL-DELUXE
A1	CONTROL

NO. 611-1210
REV. C
MODIFIED



Onan Corporation
1400 73rd Avenue N. E.
Minneapolis, MN 55432
612-574-5000
Telex: 275477
Fax: 612-574-8087

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